Heating Piping & Air Conditioning

MARCH
1959

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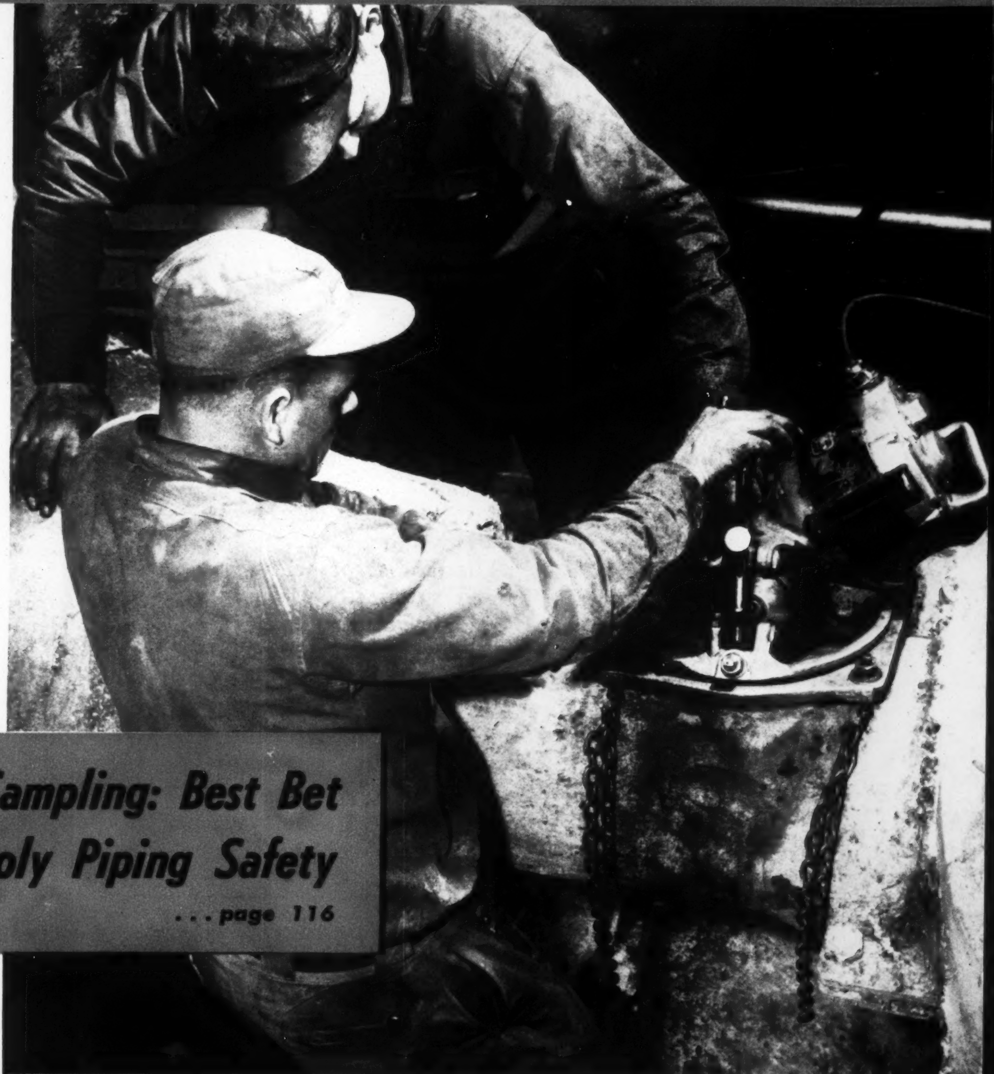

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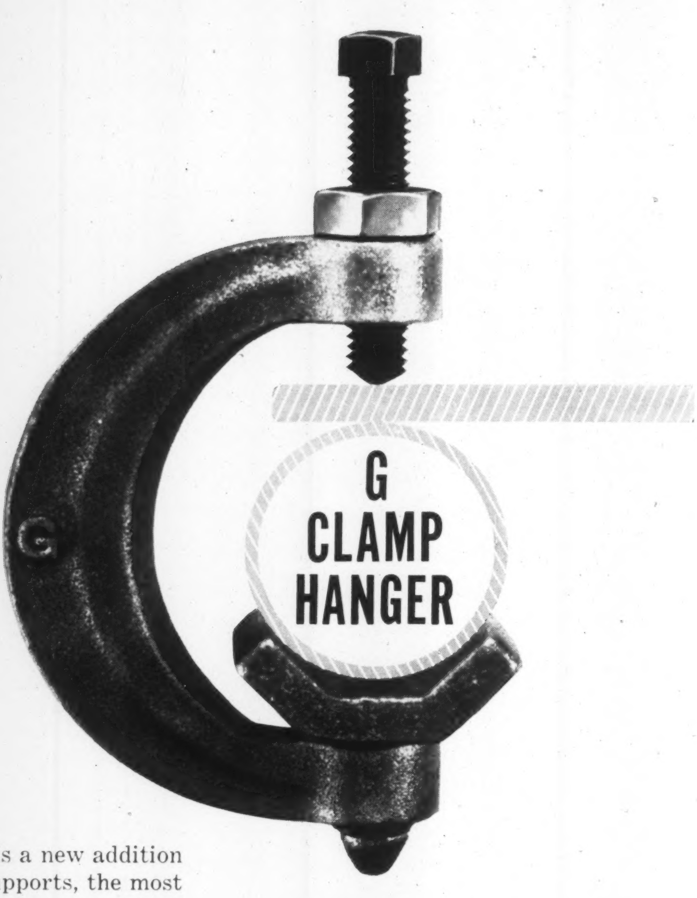
Single copy price 75c

New addition to the line of Grinnell malleable iron hangers



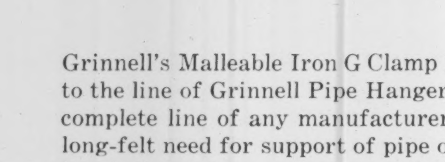
Grinnell's Malleable Iron G Clamp Hanger is a new addition to the line of Grinnell Pipe Hangers and Supports, the most complete line of any manufacturer. This hanger answers a long-felt need for support of pipe or conduit (up to 4 inches in size) where application can be made directly under structural steel.

The saddle of the Grinnell G Clamp swivels. This permits pipe or conduit to be installed either parallel or traverse to the beam axis. Separate beam clamp, rod and pipe clamp are not required, thus saving cost of supports and installation time.

Grinnell G Clamps are made of malleable iron with a ribbed design for added strength. The set screw has a hardened steel cup point for clamping rigidly to beam. Full thread engagement is provided by the tapping through the upper jaw. Approved by Factory Mutual Laboratories for use on fire protection and plumbing systems. Especially recommended for hanging conduit. Maximum recommended loads are from 210 to 450 pounds, for the smallest to the largest sizes, with a safety factor of 5.

Every Grinnell Malleable Iron Hanger offers . . .

- Safety factor of at least 5
- Thickness of metal increased at points of concentrated stress
- Homogenous metal composition throughout
- Extremely high resistance to impact and corrosion
- Economy



Saddle swivels, permitting suspension of the pipe or conduit at any angle in a plane parallel to the face of the supporting flange.

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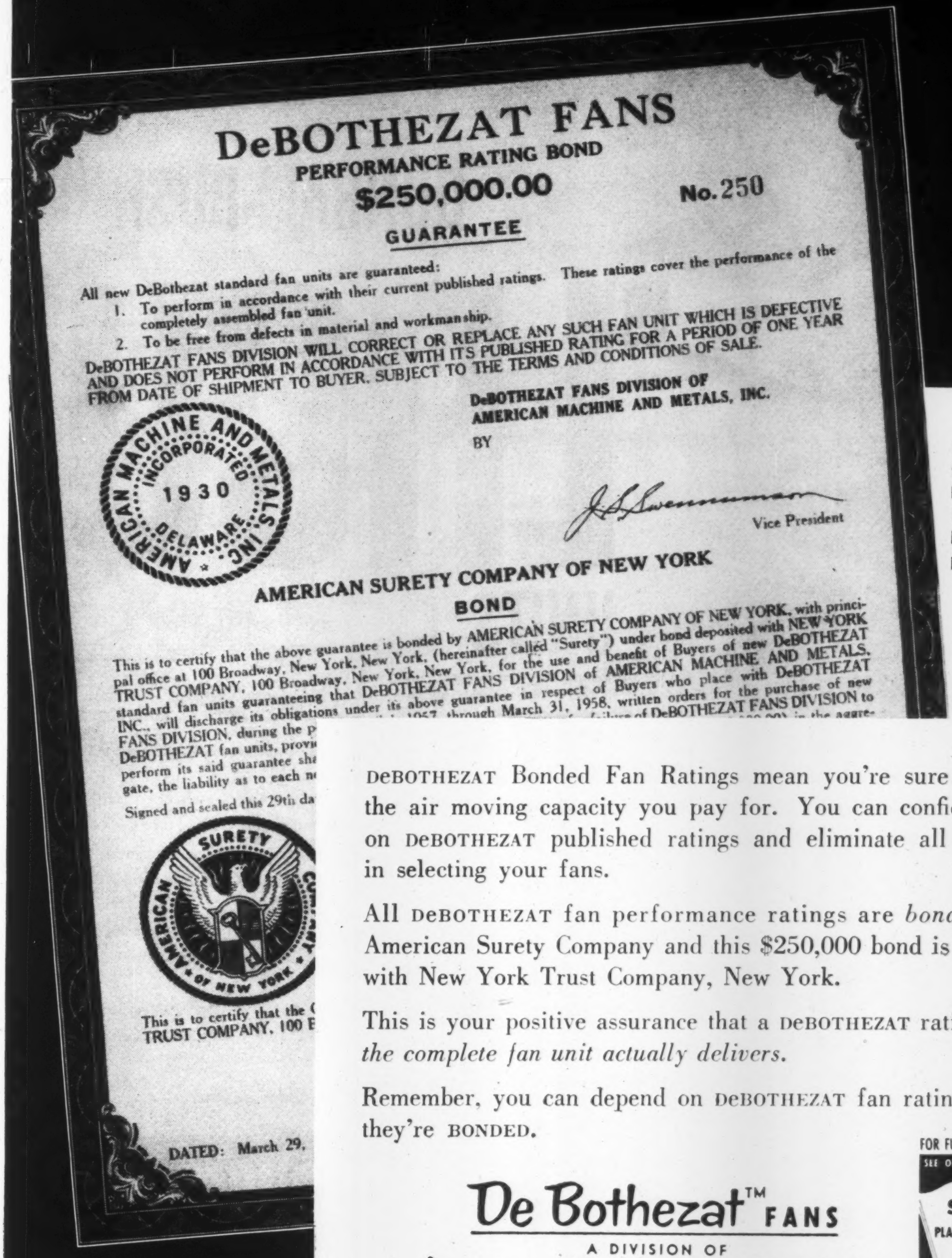

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BY

Vice President

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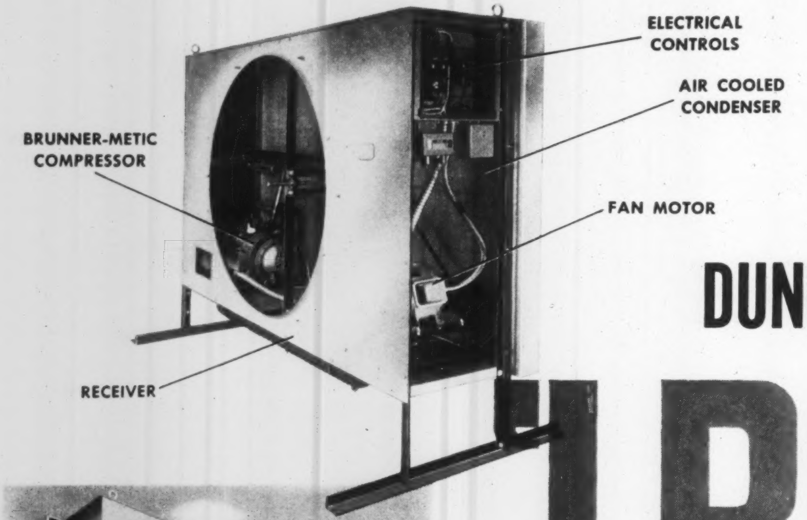
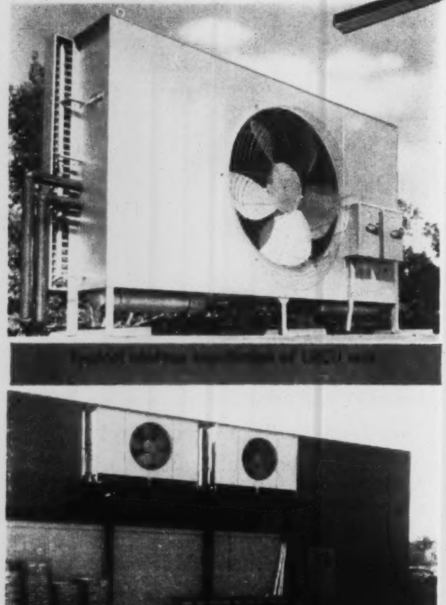
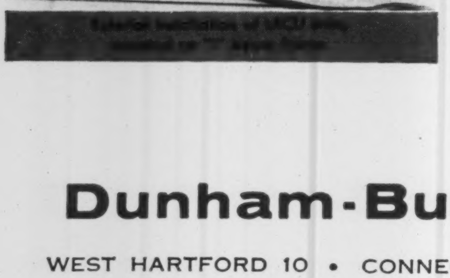
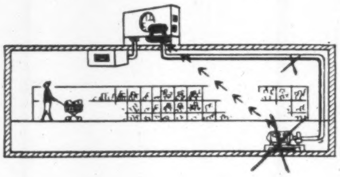
NEW CONCEPT IN BUILT-UP AIR CONDITIONING SYSTEMS



DUNHAM-BUSH 'LRCU' UNITS


Typical outdoor installation of LRCU unit


Exterior installation of LRCU units mounted on [illegible] frame



By incorporating the compressor and receiver in the same casing as the remote air cooled condenser there are substantial savings in space and installation costs on built-up air conditioning systems.

Eliminate expensive installation costs . . . plumbing . . . wiring . . . with a Dunham-Bush 'LRCU' Large Remote Condensing Unit. Here's a complete package consisting of a remote air cooled condenser, semi-hermetic compressor, magnetic starter, receiver, controls and refrigeration accessories all piped and wired.

Install on the roof (or other convenient location) and run the necessary refrigerant lines to the lowside equipment. Make electrical connections and the system is ready for operation.

Available in 5 models from 10 to 30 tons. Two-step starting makes units readily adaptable for capacity control. Two compressors furnished on 20, 25, and 30 HP units.

Write today for complete information.

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Heating Piping & Air Conditioning

Vol. 31, No. 3

(With which is merged the Aerologist)

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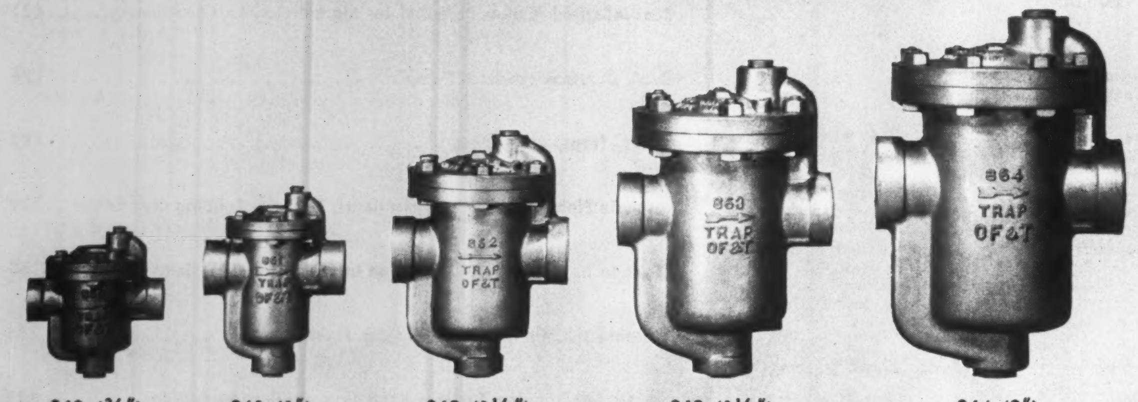
ANNOUNCING a Complete New Line . . .

ARMSTRONG Open Float and Thermostatic Steam Traps



Designed and Made by Armstrong Especially for Low Pressure Heating Service

■ Armstrong Open Float and Thermostatic Traps are the result of the demand by user-owners and contractors for an effective, trouble-free steam trap for heating service.

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When the steam is first turned on, Armstrong O.F.&T. traps quickly vent the air that has accumulated in the heating units. After start-up, the traps will vent air and CO_2 gas at steam temperature to prevent corrosion of unit heater tubes and other types of finned radiation. Condensate is removed as fast as it accumulates without loss of steam.

Advantages of Armstrong O. F. & T. Traps

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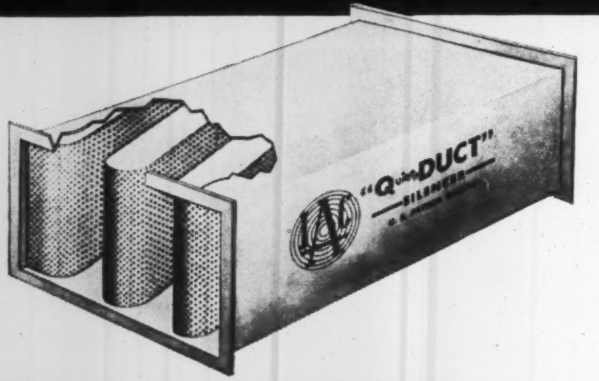
Standardized Package Silencers Have Silenced A "City Of Buildings!"



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NOW AVAILABLE IN 200 STANDARD SIZES!

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1. Quiet-DUCT Silencers measuring in length from 2 to 10 feet will give as much attenuation as a conventional lined duct measuring from 20 to over 100 ft. long, depending on the frequency involved.
2. Quiet-DUCT Silencers eliminate empirical formulae and co-efficient "guesstimates" from the acoustic design of air-conditioning, heating and ventilating systems as all attenuation data has been determined by actual tests in our laboratory and verified by independent laboratories.
3. Air-Flow vs. Pressure Drop data has also been verified by independent laboratory tests.

Quiet-VENT Silencers

IAC Quiet-VENT

Quiet-VENT Silencers are special size *Quiet-DUCT Silencers* for installation on doors and walls of air-conditioned and ventilated rooms! These unique silencers permit the free circulation of air while preventing the passage of sound in either direction.

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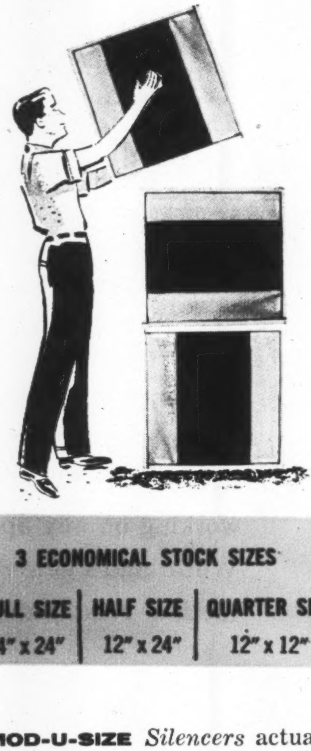
MOD -U- SIZE

Quiet-DUCT Silencers

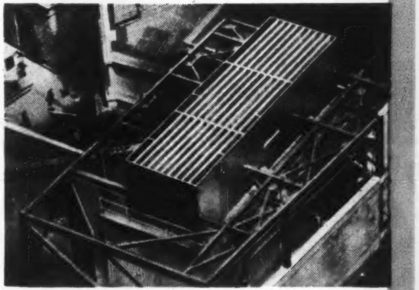


3 ECONOMICAL STOCK SIZES

FULL SIZE	HALF SIZE	QUARTER SIZE
24" x 24"	12" x 24"	12" x 12"

MOD-U-SIZE *Silencers* actually cost 20% less than other silencers—an economy made possible by production-line volume of popular sizes.

MOD-U-SIZE *Silencers* achieve further economies by reducing handling and installation costs. They can easily be built-up in parallel or in series to meet any capacity and acoustic requirement. Their smaller MODULE size enables them to be easily transported through existing doorways, etc.



COOLING TOWER

Quiet-**FLOW** Silencers

Cooling Tower Noise is controlled by *"Quiet-FLOW" Silencers* using special acoustic panels; and adjustable resonators when necessary.

Quiet-FLOW Silencers for Cooling Towers are designed to assure proper attenuation of both intake and exhaust. They are designed for minimum pressure drop to meet your specifications.

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Conic-FLOW *Silencers are designed especially for axial flow fans and the* Higher Pressure *systems.* Conic-FLOW *Silencers* are constructed in lengths from 2 to 10 feet and provide equal attenuations achieved with 20 to 400 feet of lined duct. Engineered and manufactured to an exclusive design for maximum attenuation, Conic-Flow *Silencers* can be used for high pressure as well as low pressure systems. They are applicable to jobs having high acoustic sound pressure levels.

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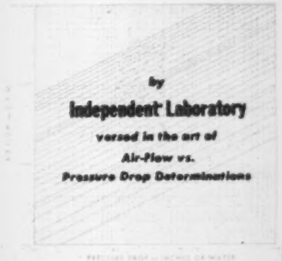
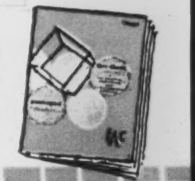


Be sure of getting the results you want by specifying Quiet-DUCT Silencers.

NEW CATALOGS AVAILABLE!

Complete technical data: attenuation, airflow vs. pressure drop, and size; are available in the new Quiet-DUCT Catalogs. Send coupon.



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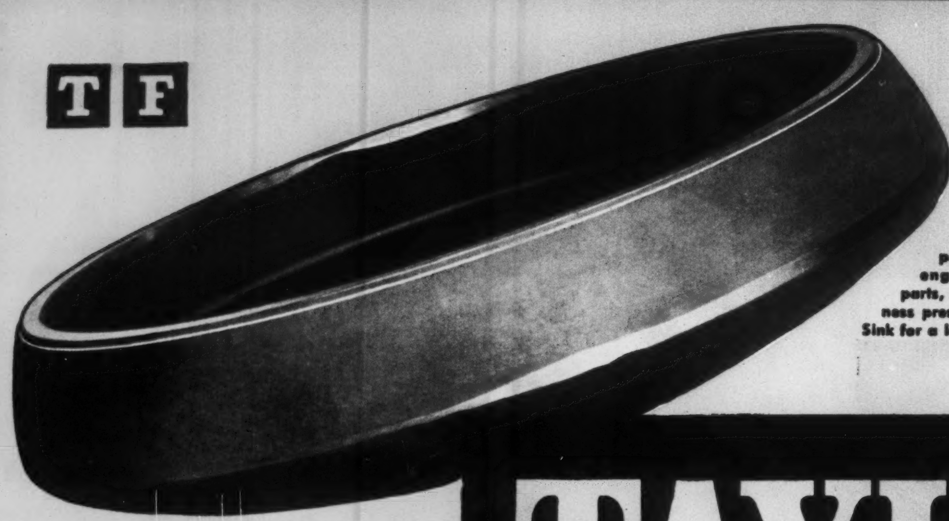

Precision Press Forgings (as well as Hammer Forgings and Extrusions) are made in quantity on a production basis as missile, rocket and engine components, heavy machinery parts, etc. This 64¾" OD x 1½" wall thickness press-forged stainless steel part is a Heat Sink for a long range missile.

TAYLOR

This 42" OD x 16" long Stainless Steel Jet Engine Turbine Case is representative of products formed by Taylor Forge ring rolling methods. Seamless rings are made in sizes to 120" OD with practically any required section.

Forged Headers with contoured outlets, made with any required outlet arrangement, are widely used for valve settings, gas compressor station manifolds, scraper traps, refinery charge heater headers, and many other applications in gas, oil and process piping. They are also made in heavy wall thicknesses for high pressure-temperature central power station service.

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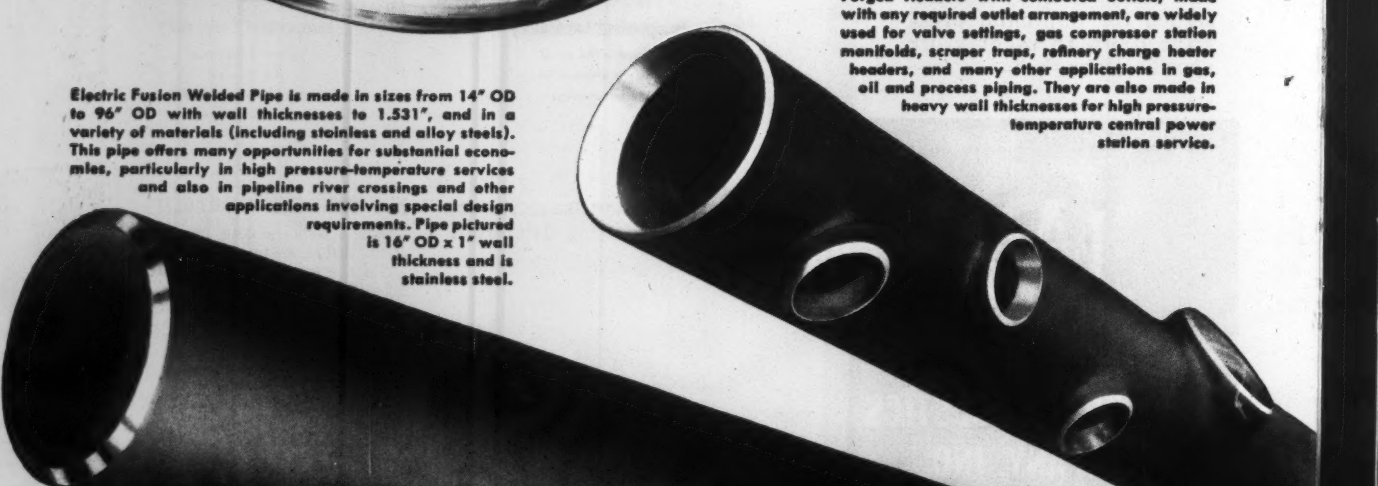

SERVING INDUSTRY with many essential products

FORGE

Traditionally
Dependable

Perhaps you think of Taylor Forge only as a maker of highest quality Welding Fittings and Forged Flanges—and certainly they are most important lines with us. But Taylor Forge is also an outstanding producer of many other less widely known though equally essential products.

The few examples pictured here are representative of the many diverse parts made by Taylor Forge to serve American Industry. One thing they have in common is the dependability, the integrity, that has always been associated with the name TAYLOR FORGE.

TF TAYLOR FORGE A 105-1

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TF TAYLOR FORGE 12¾ X .1793 TESTED TO 789 LBS. A211

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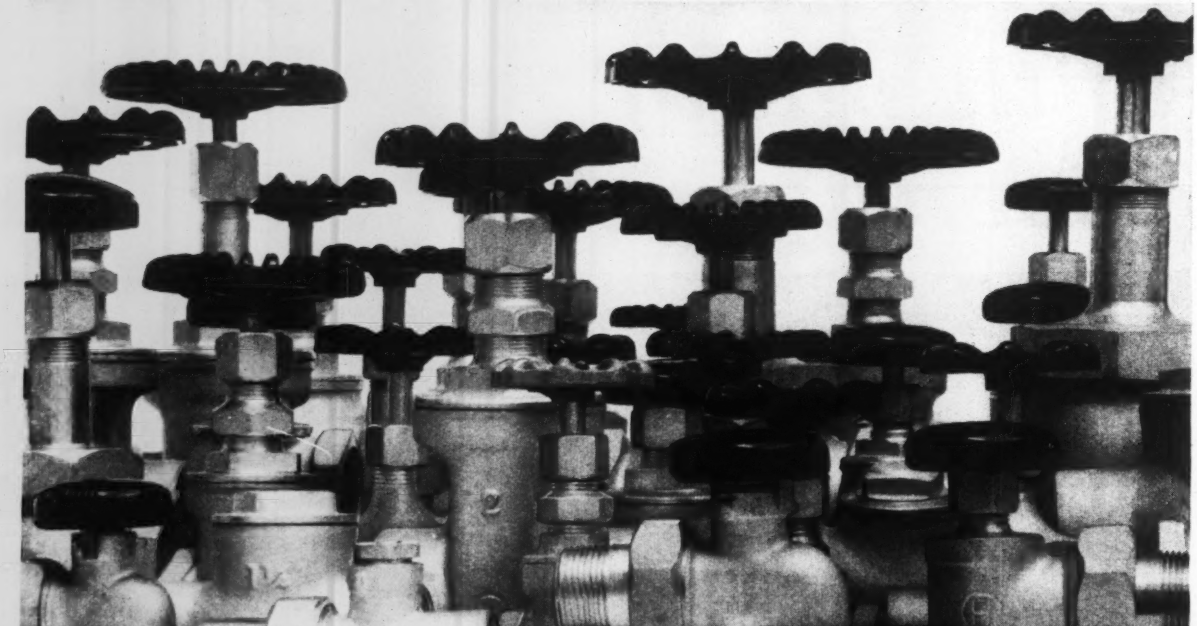

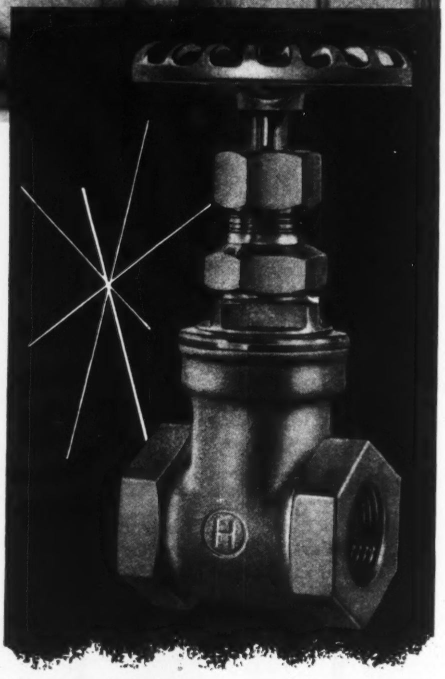

Bronze valves of high quality are our only product

Our company makes only one thing . . . a complete selection of high quality bronze valves for industrial, commercial and domestic use. And, we make enough bronze valves so that we are included among the world's largest producers.

This specialization pays important dividends to HAMMOND customers. For it means that at HAMMOND, bronze valves are not relegated to a secondary position. They receive the undivided attention of an experienced engineering staff . . . which is constantly developing new designs to meet the requirements of new applications. To date these engineers have produced over 550 different designs . . . each one to meet a specific flow control requirement.

And HAMMOND's high volume and specialized production of bronze valves . . . manufactured by the latest methods in a modern "automation" factory . . . permit economies which are passed on to HAMMOND customers. This results in surprisingly moderate prices for valves of outstanding quality . . . quality second to none in the valve industry.

A new catalog, Number 158, describes HAMMOND*'s complete line. If you haven't already received your copy, write today to Hammond Valve Corporation, Hammond, Indiana.*

HAMMOND *No. 619 is a non-rising stem, solid wedge disc gate valve especially applicable where space is at a premium. Has generously proportioned strong body and rugged construction. Available in sizes from ¼" through 3". Rated for 150 lbs. w.s.p., 300 lbs. water, oil or gas.*

H

HAMMOND *BRITE-KOTE*® BRONZE VALVES

LETTER FROM THE EDITOR

March 1959

Dear Reader:

Here's another issue which contains a wide selection of articles and information that I hope you'll find to be of help and interest. These articles and features are highlighted here, so that you can choose the ones that are of the most importance to you first.

The application of high temperature water heating to schools is discussed by John Blossom in his article beginning on page 109. Mr. Blossom has explored the use of high temperature water, or as some prefer to call it, high temperature hot water, in many types of applications including schools and hospitals, where the applications are not too common. In this article Mr. Blossom points out the design factors considered and the reasoning behind the decision to use simple tubular radiant heating elements suspended from the ceiling in an elementary school. This school is provided with a two-fan ventilation system that is operated independently to provide both year 'round ventilation and interior room cooling based upon the demand.

With the growing interest in industrial environment, this month H. E. Ziel suggests several methods for locating industrial air handling systems to provide easy maintenance. Mr. Ziel's article begins on page 113. Several detailed drawings showing how fan rooms have been planned to meet these conditions are included.

To guarantee safety from carbon-molybdenum steel steam piping failures when operating temperatures are above 800 F, it is best to follow a program of periodic sampling of the welded joints, states Helmut Thielsch in his article beginning on page 116. Graphitization of the welded joints can cause failures in these systems during the first 10 years of operation. Where sampling reveals graphitization to a dangerous degree, rehabilitation can be accomplished by solution heat treatment, gouging out the graphitized zone and depositing a new weld, or by replacement of the carbon-molybdenum material with a chromium-molybdenum alloy steel not susceptible to graphite formation.

An unlimited potential for big building air conditioning exists, according to Charles V. Fenn in his article on page 121. He says that industrial plants hold the biggest potential since only 3 to 4 percent of the total plant area in the U.S. is air conditioned. Hospitals are next in line, because patients are demanding air conditioning. The market for air conditioning commercial office buildings has now levelled off at the all-time high set in 1956. Apartment buildings are being built at a rate of 100,000 units per year, and owners are being forced to include air conditioning to hold and attract tenants. Air conditioning for schools and universities is growing and by 1970 it is predicted that all new schools will be air conditioned.

One of the speakers at the heat pump symposium held during the recent ASHAE meeting in Philadelphia was J. Donald Kroeker. He referred to operating data and experiences obtained with four water source heat pumps, all in big buildings and in the state of Oregon. He said that the heating costs averaged 2.2 cents per square foot as compared with the national average of 7.7. Cooling costs were 9.1 cents per square foot as against average costs for air conditioned office space in the U.S. of 16.9. His remarks are summarized on page 126.

This month a new feature begins by Lester T. Avery, mechanical contractor and member of HPAC's board of consulting and contributing editors in which he discusses, "Tricks, Traps, and Trends" based upon his wealth of engineering experiences in the installation of air conditioning systems. This month he tells, on page 129, how some of the mistakes of the 20's are still being made -- such as inadequate protection for freeze-up of coils.

Steam turbine driven centrifugal compressors provide 4400 tons of cooling capacity for the 10 building civic center in Los Angeles as discussed in the article on page 130. This is a new $4.5 million central plant and has been designed to make the most efficient year 'round use of steam for heating and cooling.

Another symposium held at the recent ASHAE meeting was on the subject of hydronics -- the new name for heating and cooling with water. Professor W. L. Rogers of Northwestern University discussed noise and vibration in piping systems and a summary of his presentation is given on page 133.

Thirty independent air conditioning systems provide close temperature and relative humidity control at two pharmaceutical plants of the Eli Lilly Co. in Indianapolis. George M. Bender, in his article starting on page 138, tells how these systems were designed and how they are operated. This controlled environment not only aids in the processing of capsules and tablets but additional results such as faster handling of the products, excellent quality control, and lower reject rates have been achieved.

The HPAC Data Sheet this month on page 143 has a nomograph to aid in the determination of insulation thickness to prevent condensation on chilled water pipe lines and other cold surfaces. It is referred to as a "sweat control" nomograph, and it was developed by Charles F. Gilbo.

C. T. Baker takes several case histories from his file of trouble jobs and tells what and how they were corrected on pages 150 to 152. I know you will find his analysis of these problems to be of interest.

This month's HPAC Engineering Data File is on pages 153 to 168, and is devoted to the subject of preventing failures in radiant heating and snow melting systems. This comprehensive report cites several types of piping failures resulting from contact of the piping with dissimilar metals and materials, improper support of the piping, and other causes such as improper placement of the concrete around the piping, etc. Based upon practical field experience with these systems for about 15 years, Samuel H. Nitzberg, president of Atlantic Pipebending and Fabricating Corp., served as a special contributor to this report. The many recommendations for preventing failure of these piping systems are taken from Mr. Nitzberg's experience. Others have also been consulted, and suggestions for proper design and installation procedures from them are included. Also discussed are failures of radiant heating and snow melting systems with respect to the loss of the heating effect. To prevent this type of failure, recommendations are given on the proper allowance for venting and balancing and to the properties of heat transfer media and the means by which they can be maintained to provide satisfactory performance.

Dont's miss the "Open for Discussion" on pages 97 to 100 and "Question of the Month" on pages 102 and 104. Also of interest will be the legal article by William Hurd Hillyer on page 142 and Sam Lewis' article on page 145 based on one of his many interesting experiences. The new section, "You'll Want to Know," consisting of short technical and business news items, is on pages 27 to 32.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

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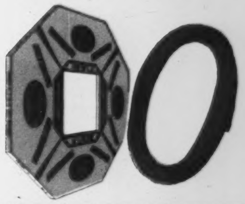

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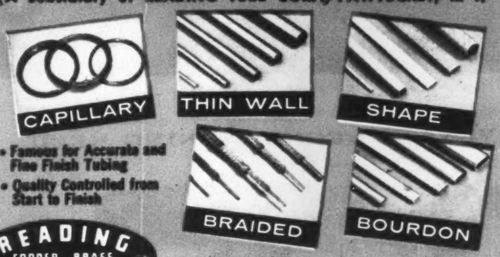

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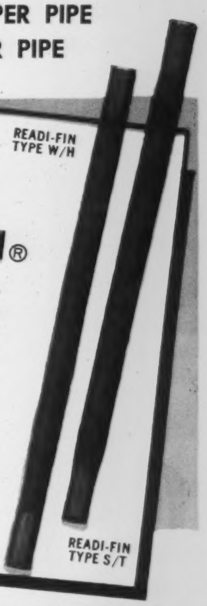

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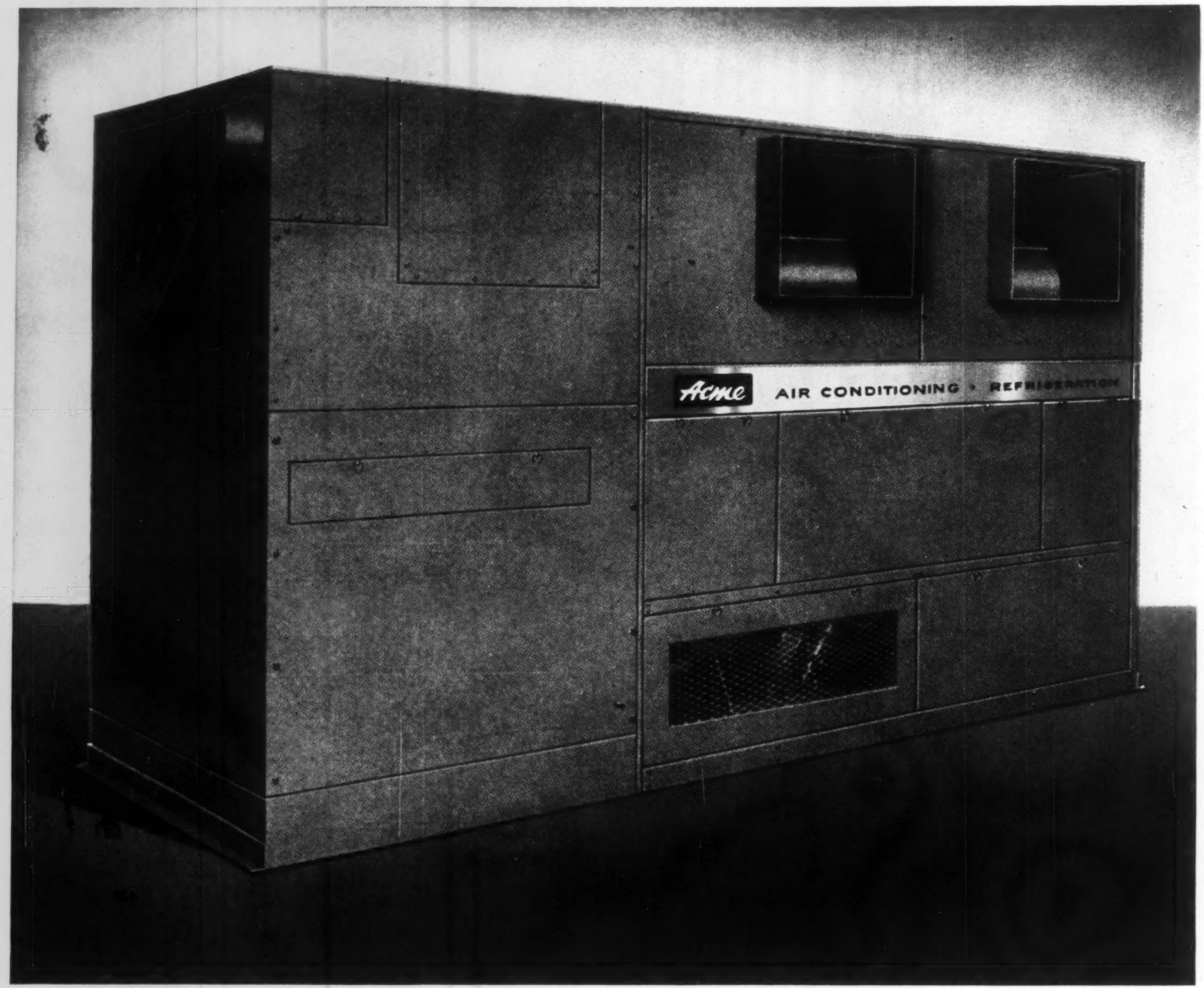
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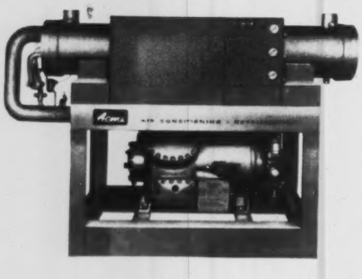
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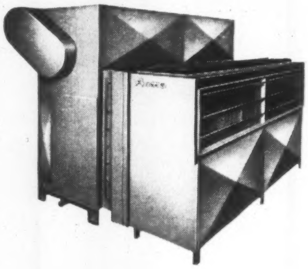

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"In air conditioning an existing building like this, copper water tube is so much easier and faster to work with it's bound to cost less to install than rustable pipe."

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Chicago, Illinois

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Air Conditioning Cont.: MEHRING & HANSON COMPANY
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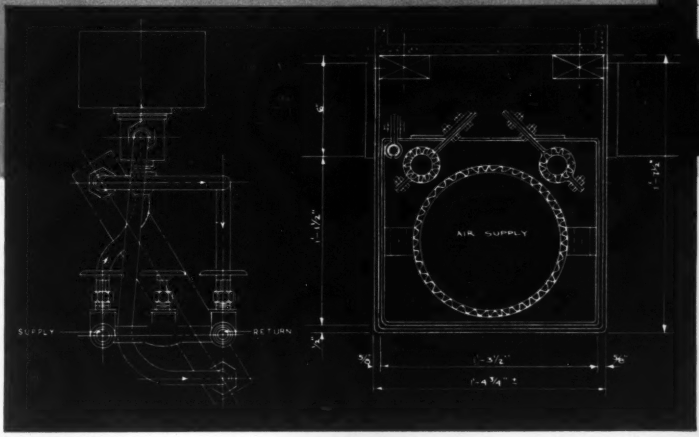

At left you see a typical detail of floor sleeves, duct risers, pipes and anchorage of the 2,500-ton refrigeration system installed in the 45-story Kemper Insurance Building.

Also shown is end elevation of installation at the fixture.

There are 3300 separate units air conditioning over 600,000 square feet of space.

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"In fact, because of the nature of the job, the Revere Copper Water Tube we used cost *much* less to install than if rustable pipe had been used," continued Mr. McClellan.

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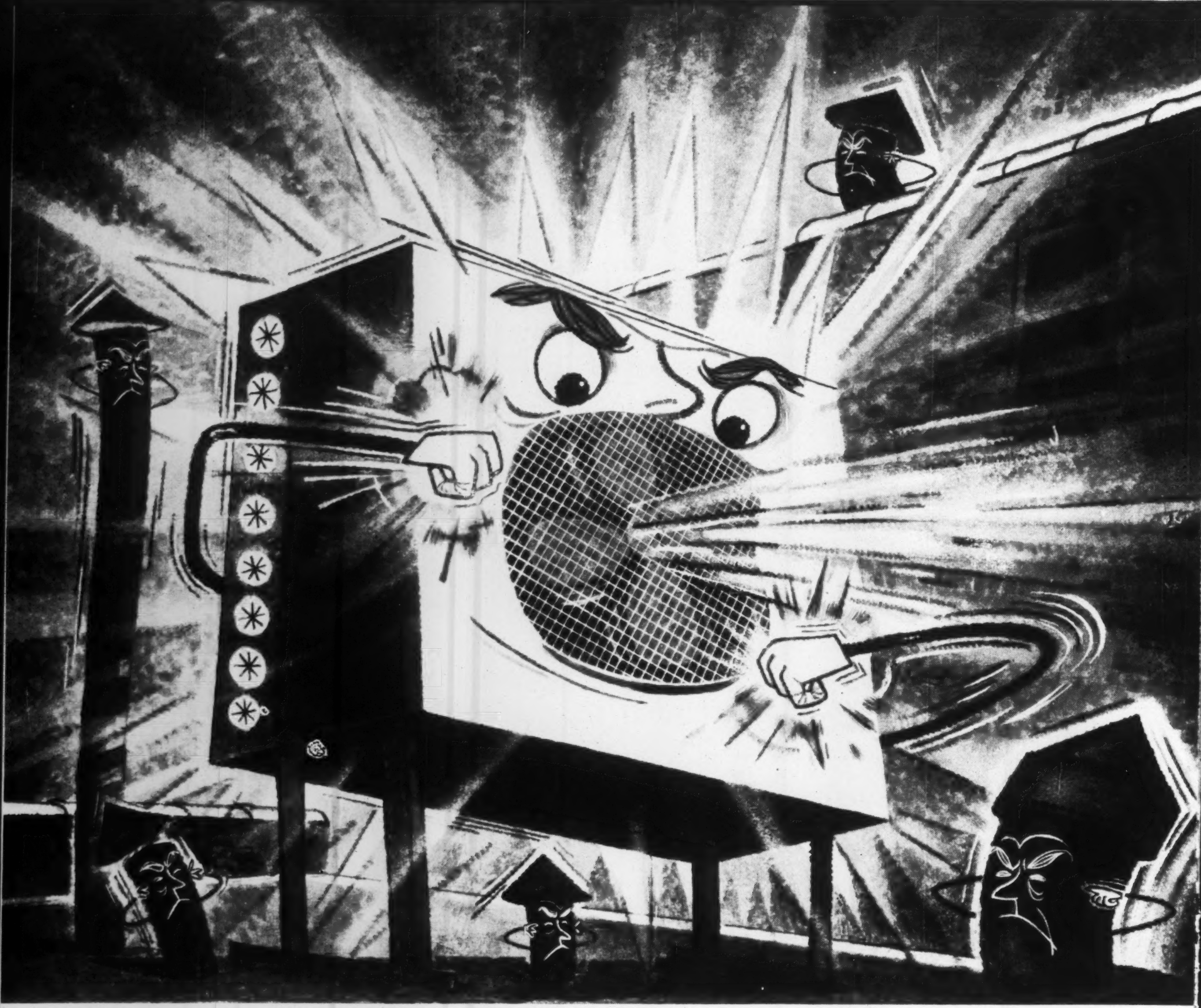

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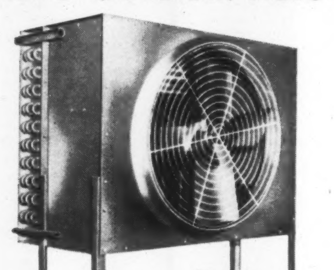

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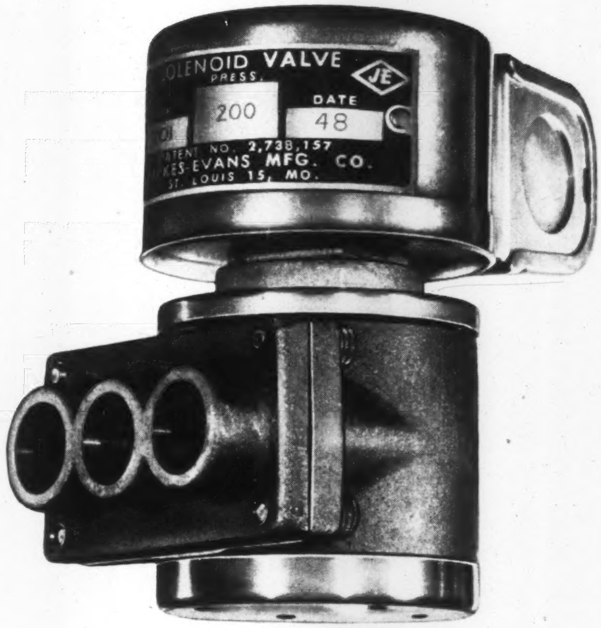

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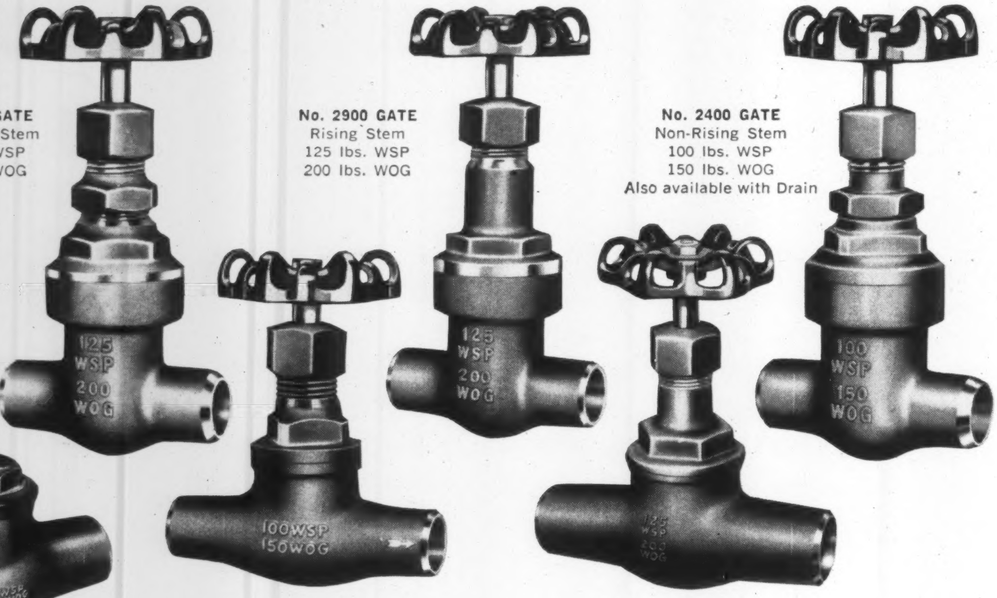

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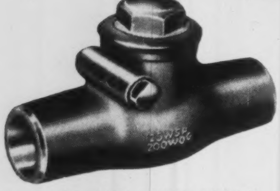

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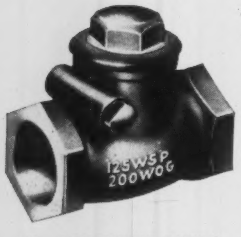

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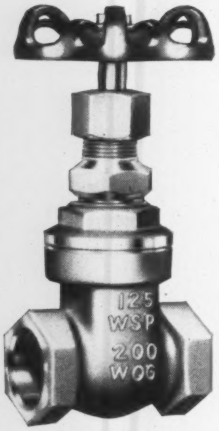

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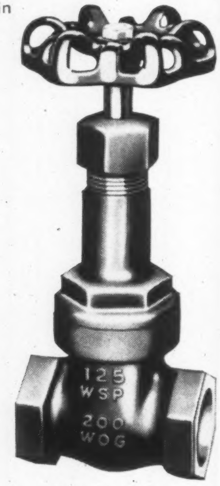

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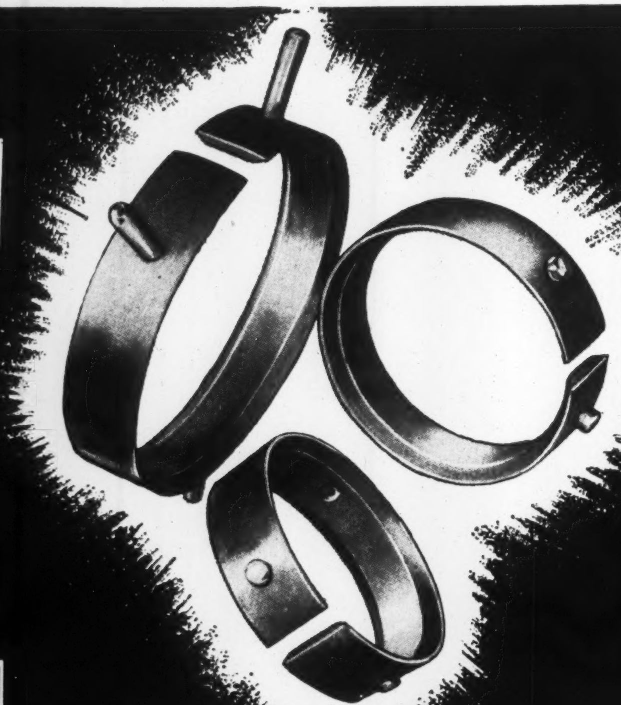

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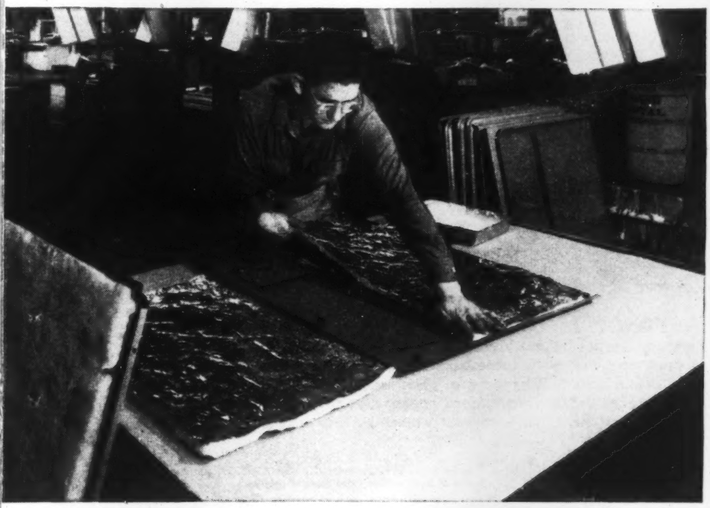

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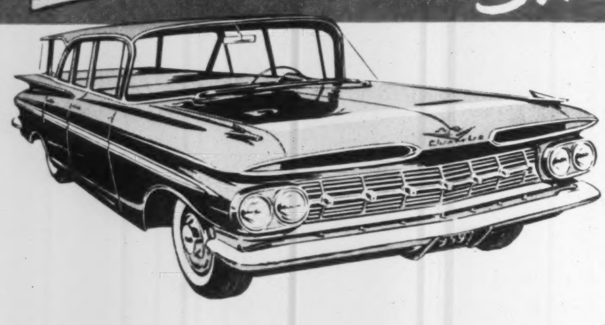

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	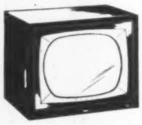	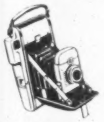	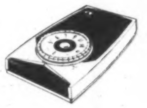
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"FREON" PRODUCTS DIVISION
E. I. DU PONT DE NEMOURS & CO. (INC.)
WILMINGTON 98, DELAWARE

Freon and combinations of Freon- and F-followed by numerals are Du Pont's registered trademarks for its fluorinated hydrocarbon refrigerants.

CONTRACTORS, SERVICE MEN . . . You are eligible to win an air-conditioned 1959 Chevrolet station wagon if your company has bought Freon® refrigerants from a complete air conditioning and refrigeration wholesaler within the contest period (January 26, 1959—May 15, 1959). Read over the simple rules and hints to help you win. Then just tell us why *you* think it's good business to deal with a *complete air conditioning and refrigeration wholesaler*. It's easy! Enter often! You can get official entry blanks through your wholesaler. Ask him about the Freon® "Partners in Profit" Contest *today*.

SIMPLE CONTEST RULES:

1. Contest is open to all firms and their employees who are customers of complete air conditioning and refrigeration wholesalers providing that the customer firm purchases "Freon" refrigerants from a complete air conditioning and refrigeration wholesaler during the contest period (January 26, 1959 to May 15, 1959). Employees of E. I. du Pont de Nemours & Co., its subsidiaries, its agencies or its wholesale distributors of "Freon" refrigerants are not eligible to enter the contest.

2. Check the quality of "Freon" most important to you.

3. Complete this statement in 35 *additional* words or less: "I believe it is good business to deal through a complete air conditioning and refrigeration wholesaler because . . .

Mail your entry to: **FREON® CONTEST, Box 22F**
Mount Vernon 10, New York

Entries must be postmarked by May 15, 1959, and received by us at least within eight days of this date.

4. You may enter as often as you like. Your entry must be your own original work and must be submitted in your own name, on an official entry blank, obtainable through your complete air conditioning and refrigeration wholesaler.

5. Prizes awarded by Reuben H. Donnelley Corp., on the basis of their judgment regarding originality, sincerity and aptness of thought. Duplicate prizes awarded in case of tie.

6. Judges' decisions are final. All entries and ideas become the property of E. I. du Pont de Nemours & Co. (Inc.). None will be returned. Contest is subject to federal, state, and local regulations.

7. Winners will be notified about six weeks after close of contest.

**Heating
Piping &
Air Conditioning**
March, 1959

You'll Want To Know . . .

Future Building Contracts Continue Upward Trend

December Total Soars 15 Percent Over Year Earlier Level

For news of new products, see the Equipment Developments department in this issue, and for new catalogs, bulletins, etc., see the Recent Trade Literature columns. Other news material also appears in the Who's What and the We Hear That departments. Meetings and Conventions are listed toward the back of this issue under that title, as are New Books and Reports.

CONTRACTS FOR FUTURE construction in the U. S. during December, 1958, rose 15 percent above a year ago, according to information just made available from the F. W. Dodge Corp. The December contracts amounting to $2,281,881,000, brought the annual total for 1958 to an all-time high of $35,090,000,000, marking the eleventh consecutive record year.

The most remarkable feature of the 1958 contracts was said to be the sharp rebound that took place beginning in April after a poor first quarter. Contracts for future construction in the later months not only recovered the ground that was lost but also set new all time highs on several occasions and wound up with an annual total a full 9 percent greater than the previous record set in 1957. These gains in the country's largest fabricating industry played an important role in reversing the nationwide recession and supporting the current recovery.

Contracts for non-residential buildings in December amounted to $747,555,000, a gain of 7 percent over December 1957. Contracts for commercial buildings, schools, and public buildings scored the largest gains, while manufacturing buildings continued well below the year-earlier levels.

Heavy engineering contracts let in the month of December totalled $553,314,000, up 5 percent from December, 1957. Contracts for utilities dropped sharply but this was more than offset by substantial gains in public works.

For the year 1958 as a whole, residential building contracts amounted to $14,695,531,000, up 13 percent over 1957; non-residential building at $10,948,334,000, was down 3 percent; and heavy engineering at $9,445,838,000, was up 20 percent. Total construction contracts, as indicated earlier, were valued at $35,090,000,000, an increase of 9 percent over 1957.

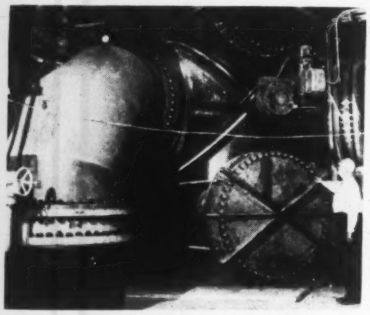
5 Ft Diam Reversing Valves Used in Power Station Job

OVER 8000 valves have gone into the Thos. H. Allen Electric Generating Station at Memphis, Tenn. They range in size from huge 5 ft nominal diameter reversing valves down to tiny ¼ in. instrument valves.

Two of the reversing valves, standing 18 ft high and weighing 16 tons each, were installed in each condenser for backwash. Each condenser also has four 9½ ft high butterfly valves—these weigh "only" 4 tons—and there are six more such valves at the pump house, one in each discharge line. When the plant is in full operation, a total of half a billion gal of cooling water will pass through these valves each day.

The small valves are found mostly on instrument sensing and air loading lines. Between the two extremes, the plant will have practically every type of valve made.

Burns and Roe, Inc., New York engineers who designed the plant for the Memphis Light, Gas, and Water Division and are supervising its construction, calculate the investment in valves alone to be $1½ million, or about 1¼ percent of this $121 million project. Valve costs break down as follows: $500,000 for 57 high pressure valves for boiler feed and bleed steam systems; $250,000 for 36 circulating water system valves; the remainder for standard valves in the piping systems.



The design features of the power piping systems for the Thos. H. Allen Electric Generating Station, were discussed in the article "Many Factors Must Be Juggled To Arrive at Most Suitable Power Piping Design" by Frank M. Kamarck, Staff Mechanical Engineer, Burns and Roe, Inc., in the November, 1958, issue of Heating, Piping & Air Conditioning on pages 95-104.

Predict Building Volume To Double in 10 Years

in the nation—is forecast for the next A MASSIVE building program totalling $600 billion—more than the present value of all existing private structures 10 years, according to John Noble Richards, president of the American Institute of Architects at the Institute's 40th annual convention in Miami, Fla.

Mr. Richards said there is a backlog of public construction—schools and hospitals in particular. And in addition, the nation must keep pace with the "staggering population increase," which means new factories and commercial structures must be built.

The architects and contractors, he said, share a responsibility to build not just a bigger America but a better, more efficient and most of all a more beautiful America.

You'll Want To Know

Develop New Filter For Radioactive Particle Collection

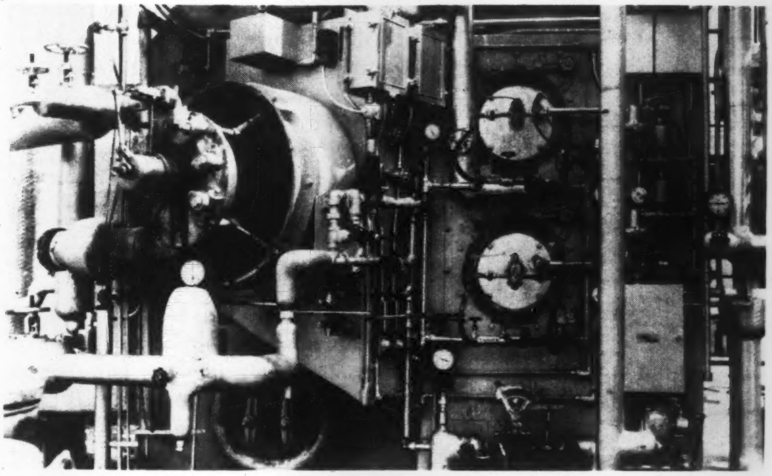
A NEW method of collecting radioactive particles in the upper atmosphere for subsequent measurement is now possible with a fiber filter recently developed at Stanford Research Institute.

Radioactive particles that float down to earth are not the only aspect of the fall-out detection and measurement problem. Many of these particles are so small and light that they remain suspended in the upper atmosphere. Much remains to be learned about their distribution and movement at high altitudes. These particles are extremely small, less than 1 micron (25/1000ths of an inch) in size.

The new filter is based upon a technique for building up a filter mat by spraying into the air through a fine nozzle a specially developed solution of polystyrene in methylene-chloride solvent. Upon exposure, the solvent evaporates almost instantaneously, leaving thread-like fibers less than 1 micron thick and 1 in. long. The newly formed fibers are directed by the spray force against a 2 ft square of dacron mesh vertically mounted about 4 ft from the spray nozzle and built into a filter mat. The mat is then rolled under pressure to increase its cohesion and strength.

The new fiber filter has a high collection efficiency, retaining 99.5 percent of the particles it picks up. This characteristic makes it suitable for obtaining submicron-size materials—some as small as 0.01 micron—for later analysis.

The filter can be completely burned away, leaving only radioactive residue ready for analysis. Other possible uses for this type of filter are for sampling particles in smoggy atmospheres, and for air cleaning. Work is continuing on methods for improving the strength of the finished filters.



Outdoor Type Packaged Boilers Power New Asphalt Refinery

In the power plant of Cities Service Oil Co.'s new asphalt refinery at Linden, N. J., are two outdoor type packaged boilers each with a guaranteed continuous rating of 40,000 lb of steam per hr at 150 psig, according to the L. J. Wing Mfg. Co.

Selected for the job of supplying draft for the two boilers were two turbine blowers. The two blowers have a maximum specified capacity of 13,000 cfm at a static pressure of 7.7 in. water gage with sufficient reserve for operating the boilers at even higher ratings if necessary.

The turbine drives provide normal operation of the boilers during periods of electrical power failure. Since most of the heat of the steam is recovered, the forced draft is obtained at a minimum cost. A saving of 25 electrical hp on each unit is achieved.

Solar Future Predicted For Heating, Cooling

Because of increasing conventional fuel costs and improved engineering techniques, solar heating and cooling will someday be economically feasible, according to E. Y. Harper, head of the engineering division of the Association for Applied Solar Energy.

In order to reduce the first cost of solar collection equipment, a solar collector is needed which will serve as a structural building material, capable of supporting load. The association has constructed, with the help of Douglas Aircraft Co., Inc., a test panel made of paper honeycomb, faced on one side with a finned metal sheet, painted black. The other face is of standard sheet metal. The panel is strong and light. A transparent plastic glazing over the finned surface promotes high collection temperatures when air is passed between the finned surface and the glazing.

Experience with the solar heating installation, located in the desert near Phoenix, indicates that perhaps air is a more desirable working fluid in solar collector systems than water. Corrosion and leakage problems could be avoided as well as the cost of the piping and the heat exchangers. However, problems are introduced when air is used. For example, a suitable means of heat storage for night time use presents a problem.

Work being done on "selective surfaces," which promote high collection temperatures even without glazing, may prove successful in 1959. However, most of the work done this year will be of a research nature and will have no immediate effect on industry.

ARI To Issue New Directory of Certified Units

A new Directory of Certified Unitary Air-Conditioners will be issued in mid-March, replacing the original Directory, issued about January 1, and the February Supplement, it was announced by Frederick J. Reed, chief engineer of the Air-Conditioning and Refrigeration Institute.

The Directory of Certified Unitary Air-Conditioners is one of the keystones of the certification program for such equipment, which is now being participated in by 34 manufacturers of unitary equipment, representing well over 80 percent of the nation's total output. The program was developed in cooperation with the National Warm Air Heating and Air Conditioning Association.

It was also announced that a deadline of March 2 was set for supplying certification data to qualify equipment for inclusion in the Directory. The new Directory will bear a prominently displayed note to the effect that it supersedes all previously issued directories and supplements.

The January Directory and February Supplement have included ratings of the equipment of 24 of the 34 currently participating companies. These ratings, plus those of most of the others, are expected to be included in the March Directory, along with those of companies which are expected to enter the program during the period prior to the deadline for supplying test data.

You'll Want To Know

Water Treatment Fights Acid In Skyscraper Cooling Water

THE FIGHT against the corrosive effects of a city's water supply on air conditioning systems and piping is graphically demonstrated in the anti-corrosion program developed for the new 34-story gold colored aluminum skyscraper at 575 Lexington Ave., New York City.

After only one week of operation, a water sample taken from the cooling tower showed that the water was already acidic. The analysis, which showed a pH of 5.9 also revealed the presence of 57 ppm of iron.

Normally, the pH of New York water is about 7. According to Dr. Sidney Sussman, chief of Water Service Laboratories, Inc., if the water in the cooling tower of the gold skyscraper had continued to go untreated, the oxygen, carbon dioxide, sulfur dioxide and other corrosive impurities which would have been absorbed by the cooling tower water as it was sprayed through the atmosphere, would have dropped the pH to 2.5 or 3 in a matter of weeks. Such a condition would inevitably lead to leaks, a possible breakdown and a costly repair bill within a year or two. A pH or 2.5 or 3 is equivalent to a solution of strong acid.

Water treatment was started immediately. Continuing analyses of the water, made at weekly intervals, showed a marked reduction in the acidity of the water. The last test made just before the system was laid up for the winter showed a pH of 8.

The air conditioning equipment includes a condenser cooling water system with a cooling tower, and a closed chilled water system. The cooling tower has a capacity of 2000 tons of refrigeration. The three cell tower on the roof handles 6000 gal of water per min. Two 3000 gpm pumps circulate the water between the cooling tower and the condensers. Two 900 ton steam driven turbines drive the compressors.

You'll Want To Know

Complete Petroleum Air Pollution Study In Los Angeles

A 30-MONTH study of air pollution emissions from petroleum refineries in Los Angeles County has been completed with the issue of the final report of the joint study group representing the United States Public Health Service, the California State Department of Public Health and the Los Angeles County Air Pollution Control District.

In his report to the board of supervisors, control officer Smith Griswold pointed out that refinery sources have been equipped with air pollution control devices costing approximately $33 million during the last 10 years, and that these represent the most advanced engineering techniques available today.

Among the pollution losses inventoried by the survey teams were hydrocarbons, oxides of nitrogen, sulfur dioxide, sulfur trioxide, ammonia, particulate matter, aldehydes and organic acids.

The final report on pollution losses reveals that refineries account for 7 percent of all hydrocarbons and 8 percent of all oxides of nitrogen emitted daily into the Los Angeles atmosphere. Approximately 70 percent of all contamination of this sort in the county is traceable to motor vehicle exhausts, according to Mr. Griswold.

The report disclosed that hydrocarbon losses of 103 tons daily are occurring at refineries, along with emissions of 115 tons of sulfur dioxide, 56 tons of oxides of nitrogen, 10 tons of particulate matter, 5 tons of sulfur trioxide, 5 tons of ammonia, 3 tons of aldehydes and 3 tons of organic acids.

"That emissions of hydrocarbons from Los Angeles County petroleum refineries have been reduced to a level of approximately 100 tons per day is a real tribute to the effectiveness of the air pollution control program," said Mr. Griswold. He added: "These emissions result principally from the operation of 16 major equipment categories in 18 petroleum refineries. In these plants are more than 400,000 individual points . . . capable of emitting air contaminants."

Mr. Griswold said further reductions are anticipated in sulfur dioxide control when Rule 62, limiting refineries and steam power plants to the use of natural gas instead of fuel oil during the smog season, goes into effect next May 1.

As a result of the merger of the ASHAE and the ASRE, the ASHAE's semi-annual meeting scheduled for this June in Vancouver has been postponed a year. The first annual meeting of the merged society (ASHRAE) will be held at Lake Placid, N. Y., June 22-24.

Good Attendance At 14th Heating and Air Conditioning Exposition

THE 14th International Heating and Air Conditioning exposition was held in Convention Hall in Philadelphia during the last week of January. It exceeded any previous display there in size and attendance, and for the first time occupied the auditorium and all exhibition halls. Over 450 exhibits were assembled from the entire U. S.

Attendance outran expectations, especially on the crowded opening day. Visitors registered from all of North America and 20 foreign countries for a week's total of 20,000.

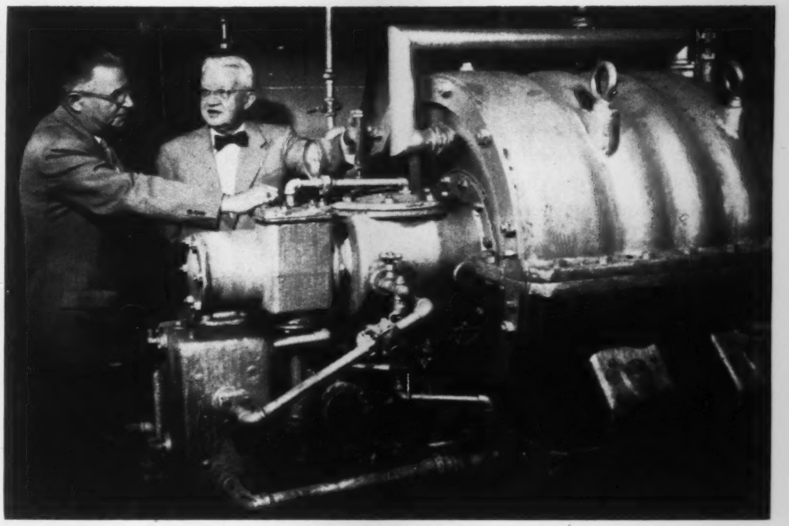
Over 2600 registered for the ASHAE meeting, held concurrently with the exposition, of which about 1500 were members of the society, 800 were guests and the rest ladies. Attendance at the exposition was excellent during most hours when the show was open and the aisles were filled with interested visitors to the displays.

In addition to the equipment and products on display (which were previewed in the special Show Section of the January issue of Heating, Piping & Air Conditioning), visitors were also impressed by the manner in which the exhibits were presented.

Engineers Made Partners In 58 Year Old Firm

TWO PROFESSIONAL ENGINEERS are among five new partners of the 58 year old John Graham Co., Architects and Engineers, with main offices in Seattle and New York and branch offices in several other cities.

Graham, who has headed the firm since the retirement of its founder, John Graham, Sr., announced that Roderick Kirkwood, P.E., in Seattle, and Henry A. Birner, P.E., in New York, have been named partners along with AIA members Manson O. Bennett, Jack L. Follett, and Nathan Wilkinson.



First Centrifugal Refrigerating Machine Retired After 36 Years of Service

THE WORLD'S FIRST centrifugal refrigerating machine — a development that revolutionized the air conditioning industry — was officially retired recently at Syracuse, N.Y.

After 36 years of duty as an experimental unit and in the service of Onondaga Pottery Co., manufacturer of Syracuse china, the historic unit will be displayed at the home of its builder, Carrier Corp. For most of its life, the machine provided chilled water for use in air conditioning the shop where decals for chinaware are printed.

Comparing the old and new in size and capacity, it was stated that the space occupied by the original took up almost twice as much as a modern automobile. Today's units take half the floor area, and produce 35 to 50 times the capacity.

When developed in 1922 by the late Dr. Willis H. Carrier the "centrifugal," as the machine is called, provided a number of advantages over other refrigerating equipment available. Its design permitted use of the first completely safe refrigerant gas, which was non-toxic, non-combustible, with an operating pressure no higher than atmospheric. If any gas leaked out it was harmless.

Though "Centrifugal No. 1" pointed the way to air conditioning for comfort, its own service was in industry. Its chilled water helped maintain a stable 72 F and 56 percent RH round-the-clock.

Thermoelectric Research Begun at Battelle

RESEARCH TO BROADEN science's knowledge of materials and techniques required for thermoelectric-cooling devices has just been started at Battelle Memorial Institute, Columbus, Ohio. Initially, the two year program is being sponsored by 16 American industrial firms interested in research basic to the use of the so-

You'll Want To Know

called Peltier cooling effect for refrigeration.

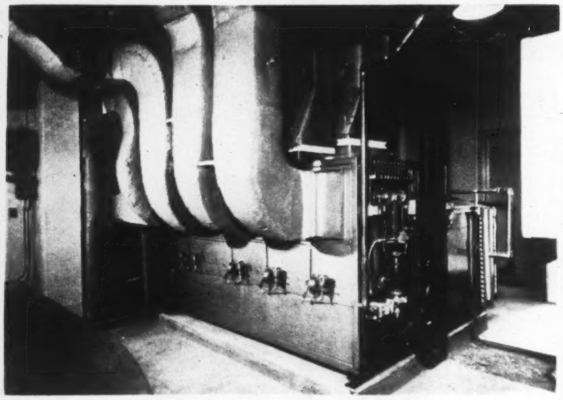
There have been predictions recently that refrigeration and air conditioning may soon be accomplished on a large scale by electronic units without either the moving parts or chemical coolants used in present-day systems. These predictions are based on the assumption that improved thermoelectric cooling materials can be developed. The Peltier or thermoelectric cooling effect is achieved when electric current causes heat to be absorbed at one junction of two dissimilar materials and released from another junction of the same materials. Devices utilizing the Peltier effect require extremely pure materials having a closely controlled combination of electrical properties.

The basic objective of the new research program is the preparation of new compounds and investigation of their resistivity, thermal conductivity, and thermoelectric power. Materials to be studied will be chosen from the following chemical systems: compounds of copper, silver, and gold with sulfur, selenium, and tellurium; compounds of zinc, cadmium, and mercury with arsenic, antimony, and bismuth; and compounds of alkaline-earth metals, such as magnesium and calcium, and of alkali metals, such as sodium and potassium, with germanium, tin, lead, arsenic, antimony, and bismuth. Combinations of these compounds in alloys will also be studied.

Dr. E. H. Lougher, who will coordinate the research at Battelle, pointed out that the study will concentrate on the thermoelectric properties of materials which have thus far received relatively little attention for thermoelectric devices.

You'll Want To Know

Hospital System Features Air Filtration



AN AIR CONDITIONING installation which was developed to take into account the broader consideration of humanity has recently been completed at the Clark County Memorial Hospital at Jeffersonville, Indiana. This system has made the institution the first fully air conditioned hospital in the area, according to Dunham-Bush, Inc.

As employed in the hospital, filtered air is one of several features in this system. Also, units in all rooms allow members of the hospital staff to keep patients in constant temperature comfort. Sanitation is also improved with dust control through filtration of all incoming air.

With the New Albany, Indiana firm of Walker, Applegate, Oakes and Ritz as architects, the Southern Engineering Company of Louisville, Kentucky served as the consulting engineers.

U A Clarifies Revision of National Temporary Heat Agreement

SOME "very unfortunate language" in a press release has created "seriously erroneous impressions" concerning the nature of the recently revised national agreement on temporary heat, according to the United Association.

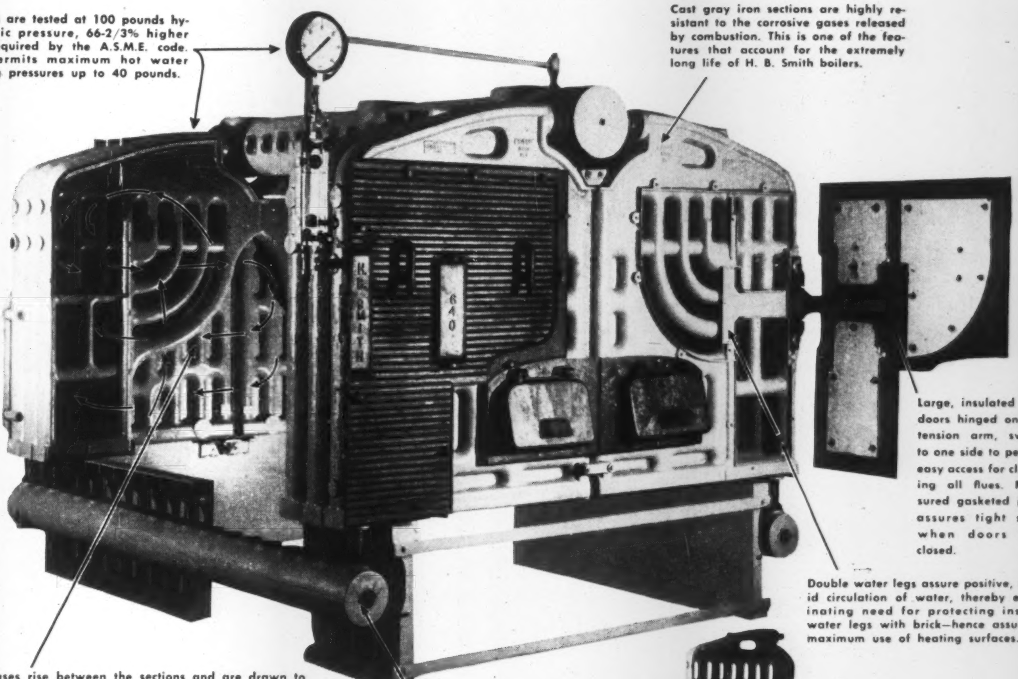
Peter T. Schoemann, general president of the UA, points out that the revised agreement provides that:

"1) Local shift provisions or other contract provisions on temporary heat which honor the straight-time rate principle, applying that principle in detail to local conditions, are still in conformity with the national agreement, just as they have been for the past 35 years, even though they may require some overtime payments under given circumstances.

"2) All temporary heat is recognized as the work of the heating contractor, with maintenance by United Association members rather than some other craft wherever temporary heat is used. The same now applies, by extension of the original agreement, to gas and oil fired unit heaters and to refrigeration and air conditioning and other installations. This means that it is optional with the owner or contractor whether to provide for temporary heat, but wherever temporary heat *is* provided, then the conditions under which it is maintained are left up to local agreement, as long as all phases of maintenance are recognized as the work of the United Association until the general tests are completed and the job is accepted by the owner.

"3) The national agreement on temporary heat only governs those matters expressly covered by the original Pittsburgh agreement, dated February 19, 1924, and local unions and contractors are completely free to negotiate such other terms and conditions as they choose, just as they have been ever since 1924."

H. B. Smith "BIG MILLS 640"
is the big news in heating boilers



Sections are tested at 100 pounds hydrostatic pressure, 66-2/3% higher than required by the A.S.M.E. code. This permits maximum hot water working pressures up to 40 pounds.

Cast gray iron sections are highly resistant to the corrosive gases released by combustion. This is one of the features that account for the extremely long life of H. B. Smith boilers.

Large, insulated flue doors hinged on extension arm, swing to one side to permit easy access for cleaning all flues. Pressured gasketed joint assures tight seal when doors are closed.

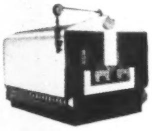
Double water legs assure positive, rapid circulation of water, thereby eliminating need for protecting inside water legs with brick—hence assuring maximum use of heating surfaces.

The BIG MILLS 640 is ideal for replacement work in larger buildings. Individual sections can be moved through conventional entrances. The 640 can be increased in size to a depth of 20 sections.

Hot gases rise between the sections and are drawn to each side of the boiler where they pass through the upper flue channels. They are then drawn downward to the lower flue channels and move to the back of the boiler and into the smoke hood. Maximum value of the fuel is utilized by the time the gases reach the chimney, resulting in low stack temperatures.

Note the large amount of heating surface presented by each section. This means rapid absorption of heat and fast steaming.

Horizontal drums under the double water legs trap any silt present in the make-up water. The drums are located outside the heat zone: silt cannot "cake" and is easily flushed out.



Meets demand in large institutional buildings

BIG MILLS 640 is the brand new cast iron water tube boiler of advanced design in the size range of 100 to 200 horsepower.

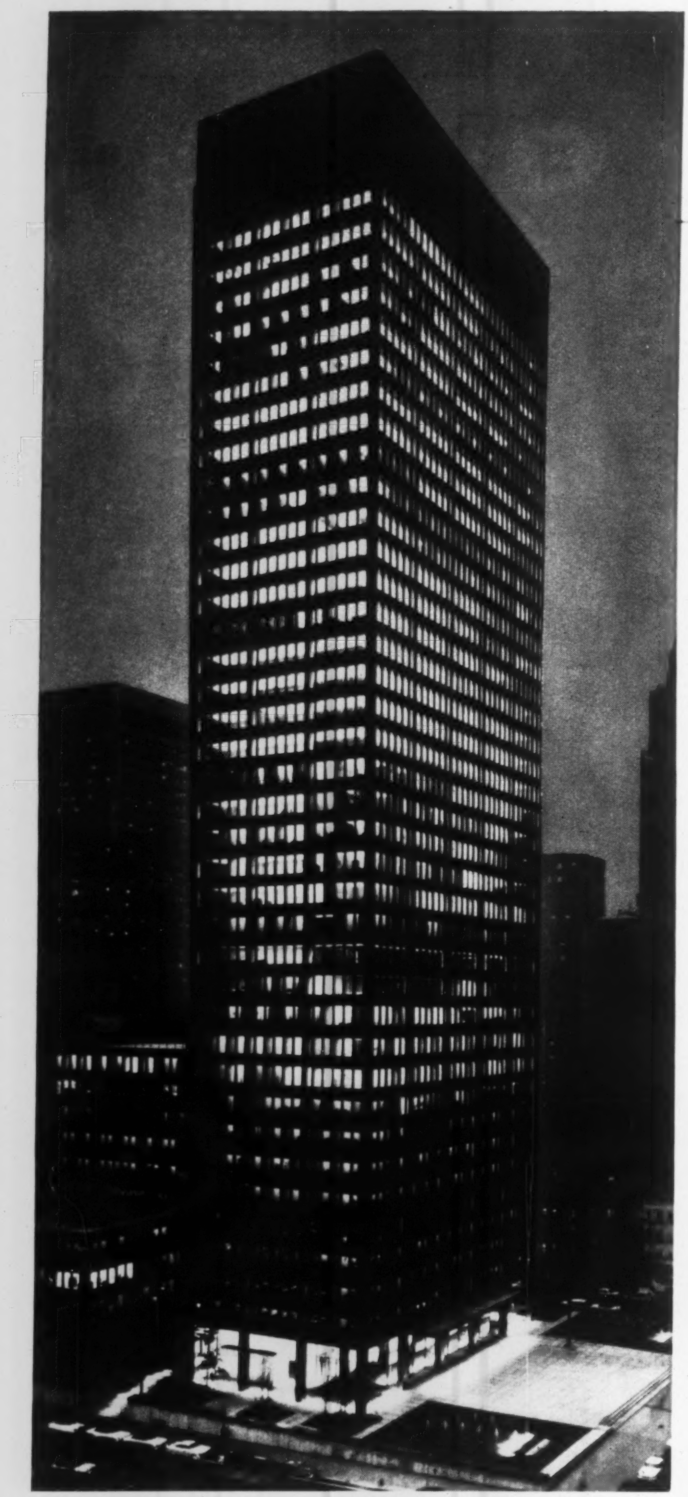
Based on the time-tested and proved Mills principles, it embodies refinements and improvements which place it far ahead of any boiler of comparable capacity — with the added advantages of long life and low operating cost.

The 640 is designed for efficient use with horizontal rotary oil burners or gas burners. All sizes operate with 55-foot chimneys with natural draft — lower chimneys than are required by any other boiler of its size — cast iron or steel.

Write for the new bulletin which illustrates and describes this boiler and gives complete engineering data.

H. B. Smith CAST IRON BOILERS

The H. B. Smith Company, Inc., Westfield, Massachusetts • Est. 1853



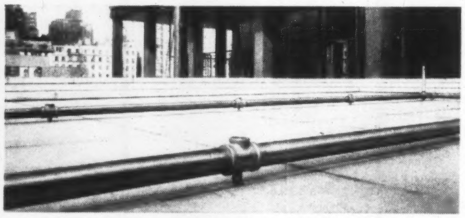
FROM THE GROUND UP . . .

World's First Bronze Skyscraper Uses Phelps Dodge Red Brass Pipe!

A vital network of Phelps Dodge Red Brass Pipe—roughly 17 miles of it—runs through the magnificent new bronze office building at 375 Park Avenue in New York. From street level to the top of this striking skyscraper, the maze of piping carries the hot and cold water needed for the 38-story structure's mammoth plumbing system.

A number of especially designed water fixtures, including a unique central drinking water system, are connected to these Phelps Dodge pipes. Other PD pipes under the park plaza supply water to the graceful fountains and pools in front of the building.

Plumbing contractors know that the famous Phelps Dodge "Mine-to-Market" quality line of copper tube and pipe more than meets every requirement for modern plumbing systems. That's why they specify Phelps Dodge for every kind of installation—from skyscrapers to homes!



Red brass pipe in pool bottoms on building plaza furnishes water for beautiful fountain displays.

Quality tube sold the quality way—through authorized wholesalers!

PHELPS DODGE COPPER PRODUCTS
CORPORATION
New York, N. Y. • Los Angeles, Calif.

IT MAKES SENSE !

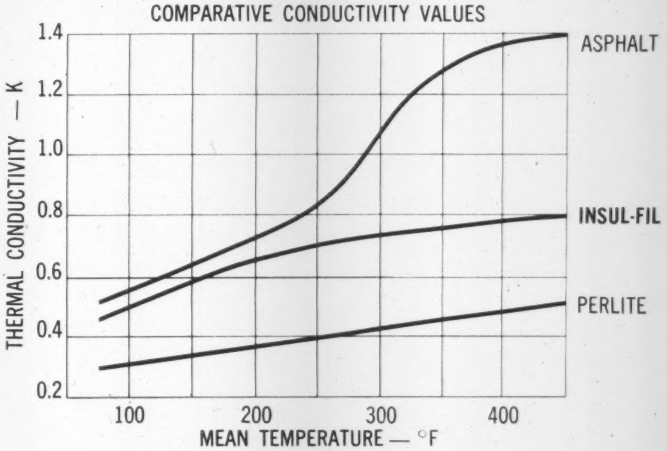
TO INSULATE UNDERGROUND PIPING WITH

insul-fil®

1 Introduction of a material such as expanded perlite into a granulated hard asphalt improves the insulating value of the blend.

2 Proper selection of asphalts by softening point to make up asphalt-perlite blends improves the insulating properties of the blend.

3 Introduction of an aggregate, such as perlite, into a granulated asphalt improves the mechanical properties of the blend once it is plasticized.



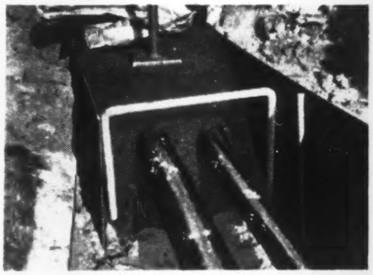
After years of extensive testing conducted at the Research and Development Department of The Atlantic Refining Company, these conclusions were presented in a Paper given before the American Chemical Society in Dallas, Texas, April, 1956. Since that time, hundreds of Insul-fil field installations have confirmed these conclusions.*

It is a well-known fact that the use of asphalt in construction created the necessity for the introduction of fillers (usually inorganic) of various types for the purpose of arresting the flow characteristics and improving the insulation value of the asphalts themselves.

The blend of hard granular asphalt and asphalt coated perlite gives Insul-fil its excellent insulating properties, water resistance and sufficient structural strength to the insulating body to resist normal soil stresses with the steam on or off.

An important Insul-fil development is the priming of the pipe with Accelerator #7591. The use of accelerator provides continuous adhesion of Insul-fil to the pipe, hastens consolidation, and gives additional protection against corrosion by galvanic action.

Paper available on request.



Insul-fil Is Simple To Install

Just pour it around the pipe to be insulated. Prod and tamp it in place and backfill. Heat introduced into the pipe forms the conduit.

Insul-Fil Company Inc.
250 Pettit Avenue
Bellmore, Long Island, N. Y.

Please send literature.

NAME__________

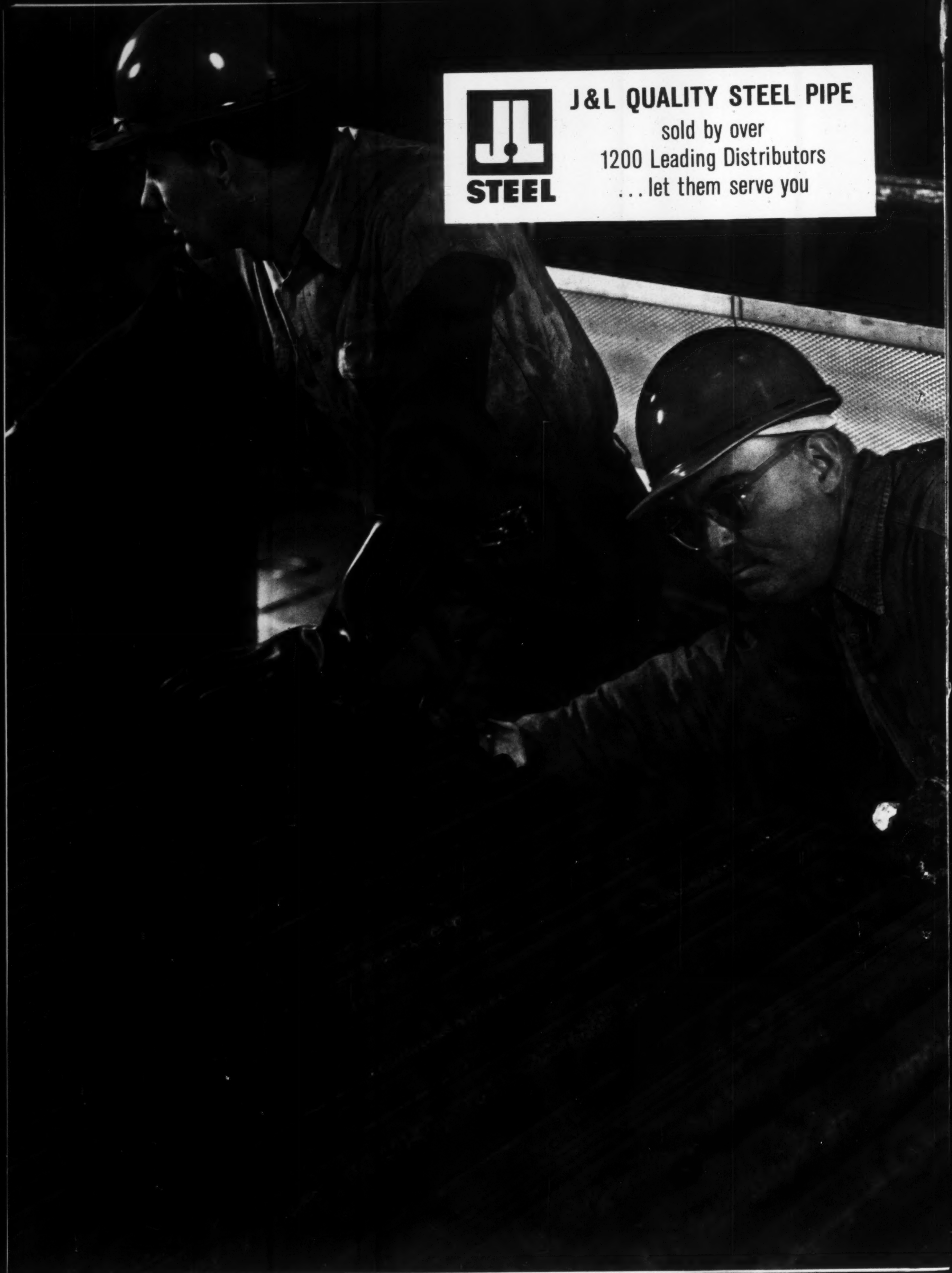
COMPANY__________

ADDRESS__________

CITY__________ ZONE____ STATE______

insul-fil ***The most efficient Granular Fill Type Insulation for Hot Underground Piping***

Insul-Fil Company Inc. DIVISION OF: MIRACLE ADHESIVES CORPORATION, 250 PETTIT AVENUE, BELLMORE, LONG ISLAND, N. Y.



STEEL

J&L QUALITY STEEL PIPE
sold by over
1200 Leading Distributors
. . . let them serve you

"More money in the bank by using J&L pipe"

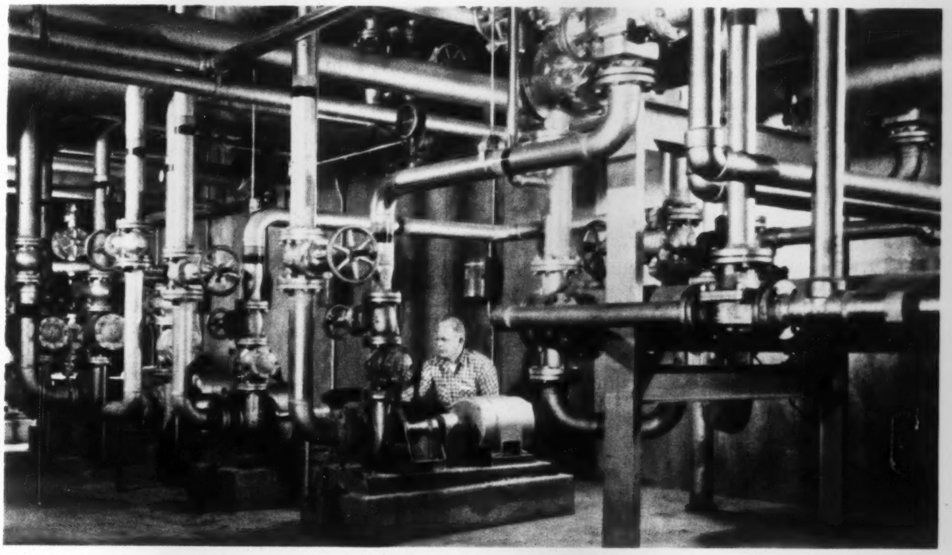
. . . reports Akron contractor

"We use a great deal of J&L standard size pipe because our reputation and our profits depend on our work and the materials we use. J&L pipe gives us sound joints and uniform strength," says Mr. George W. Spohn, of the Spohn Heating and Ventilating Company, Akron, Ohio.

This reputation for dependability of J&L pipe is built on years of outstanding performance. When you specify J&L, you get uniform thickness and size, roundness and straightness, strength and ductility.

J&L pipe is produced by a major integrated steel company on the most modern equipment. Typical of these advanced facilities are two new continuous weld mills for producing Jal-Con-Weld pipe from ½ inch through 4 inches. Jal-Con-Weld pipe is formed by pressure rolls in sizes larger than the finished diameter. Pipe is then reduced in succeeding sets of rolls. This forges the weld and improves metallurgical qualities.

All J&L pipe is manufactured under rigid quality control that assures production of superior products. It will pay you to standardize on dependable J&L pipe. Call your nearest J&L distributor or write Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Penna.

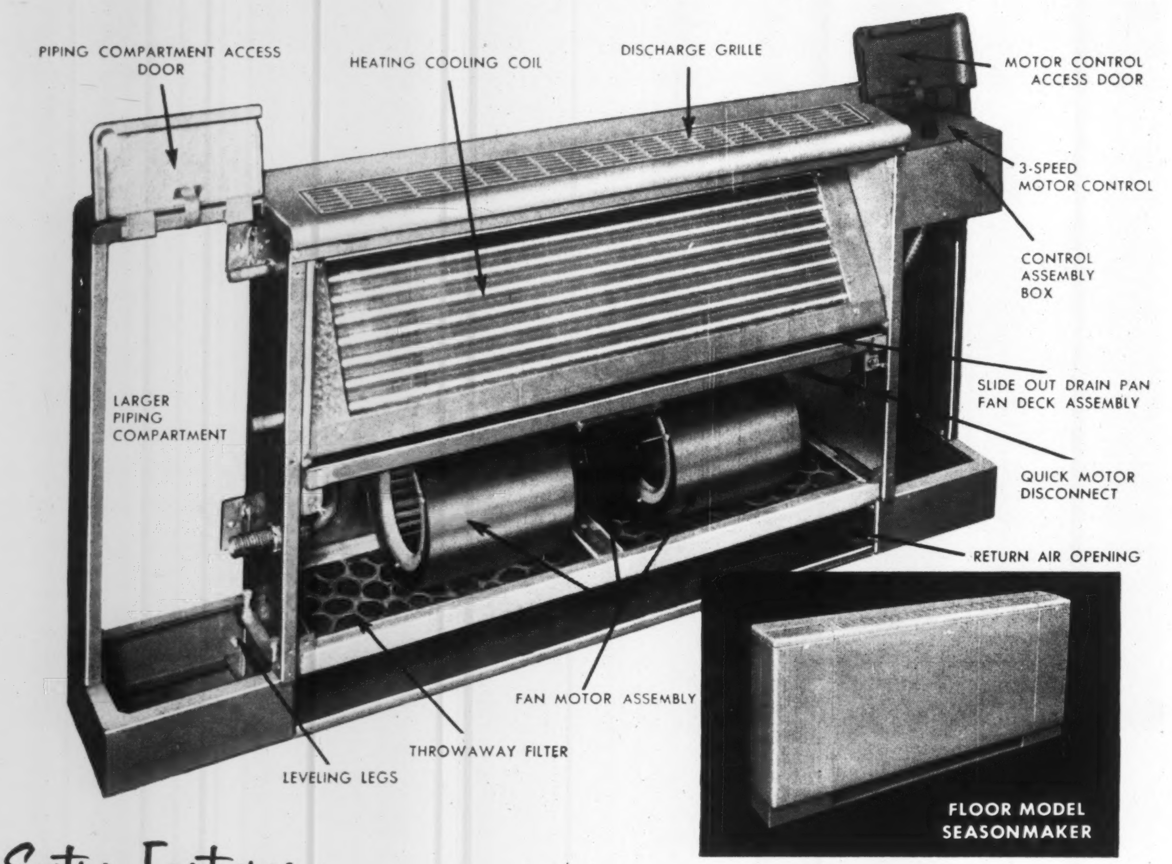


Over 300 tons of top quality J&L pipe, ranging in size from 2 inches to 12 inches, were recently installed by the Spohn Heating and Ventilating Company in this modern Akron municipal sewage treatment plant. Dependable service is a must in this operation covering a 700-mile municipal system.

STEEL

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA


PIPING COMPARTMENT ACCESS DOOR
HEATING COOLING COIL
DISCHARGE GRILLE
MOTOR CONTROL ACCESS DOOR
3-SPEED MOTOR CONTROL
CONTROL ASSEMBLY BOX
SLIDE OUT DRAIN PAN FAN DECK ASSEMBLY
LARGER PIPING COMPARTMENT
QUICK MOTOR DISCONNECT
RETURN AIR OPENING
FAN MOTOR ASSEMBLY
THROWAWAY FILTER
LEVELING LEGS
FLOOR MODEL SEASONMAKER

Extra Features Year 'Round Comfort with these thin-line design SEASONMAKER

REMOTE AIR CONDITIONERS

McQuay thin-line design individual room Seasonmaker units have been redesigned for modern, compact styling, and all are only 8½ inches thin and 25 inches high. There are four models—ceiling, hideaway, floor and basic—each in five sizes, affording a minimum of space necessary for installation.

All McQuay Seasonmakers utilize central station heating and cooling with capacities of 220, 330, 440, 520 and 640 cfm. The four smaller sizes are equipped with 1050 rpm motors, while the largest has 1500 rpm. They furnish individual room comfort at any desired temperature level—heated, filtered air in the winter and cooled, dehumidified and filtered air in the summer.

McQuay thin-line design Seasonmakers are ideal for multi-room buildings, such as hotels, apartments, motels, schools, hospitals, offices and residences. All have the three-row McQuay Ripple-Fin coils. They are ultra-quiet in operation and each, of course, has the inherent built-in quality for which McQuay is famous. For complete information, call the McQuay representative in or near your city, or write McQuay, Inc., 1601 Broadway Street N.E., Minneapolis 13, Minnesota.

4 MODELS IN 5 SIZES

EACH ONLY 8½" THIN, 25" HIGH

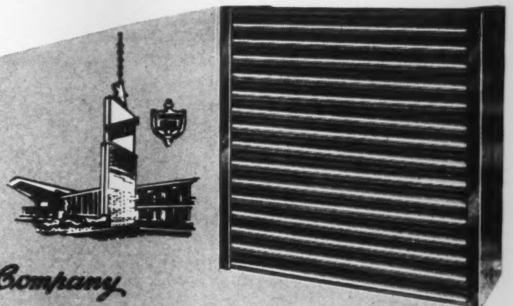
McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

MAKE THE SEASONS COME TO YOU

SERVING BUSINESS AND INDUSTRY...

dorex®
AIR PURIFICATION EQUIPMENT



NITROGEN DIVISION ALLIED CHEMICAL

ASARCO
AMERICAN SMELTING
AND REFINING COMPANY

Ford Motor Company

SHELL

E·R·SQUIBB
& SONS

SOHIO

ALCOA

General Mills

KRAFT

WESTERN UNION

DUMONT

ATLANTIC

BERGDORF GOODMAN
5th AVE at 58th ST NEW YORK 19
ON THE PLAZA

Riegel PAPER

RIEGEL PAPER
CORPORATION

Bowman
DAIRY COMPANY

ARMOUR
STAR

BOEING AIRPLANE COMPANY

ROCHE

ATLAS

Kodak

R. J. REYNOLDS
TOBACCO COMPANY

THE
PROCTER & GAMBLE
COMPANY

Diamond
Chemicals

Westinghouse

ROCKEFELLER CENTER, INC.

Western Electric
MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

BARD-PARKER
COMPANY, INC.

OAK RIDGE
NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE NUCLEAR COMPANY

UCC

BETHLEHEM
STEEL

Arthur D. Little, Inc.

Ballantine
ale & beer

Connor's research and 25 years of practical experience has resulted in ever-increasing efficiency in the recovery and purification of contaminated air for re-use in air conditioning systems.

Today, Connor's experience cuts across virtually every major business and industry . . . and various Dorex units constantly are at work purifying combined recirculated and intake air . . . severely contaminated industrial air . . . commercially contaminated intake air (smog).

With each Dorex installation, Connor assumes responsibility for economical and efficient operation . . . a responsibility lived up to for years for thousands of Dorex users.

Without obligation . . . ask us for recommendations on how to solve your air purification problem.

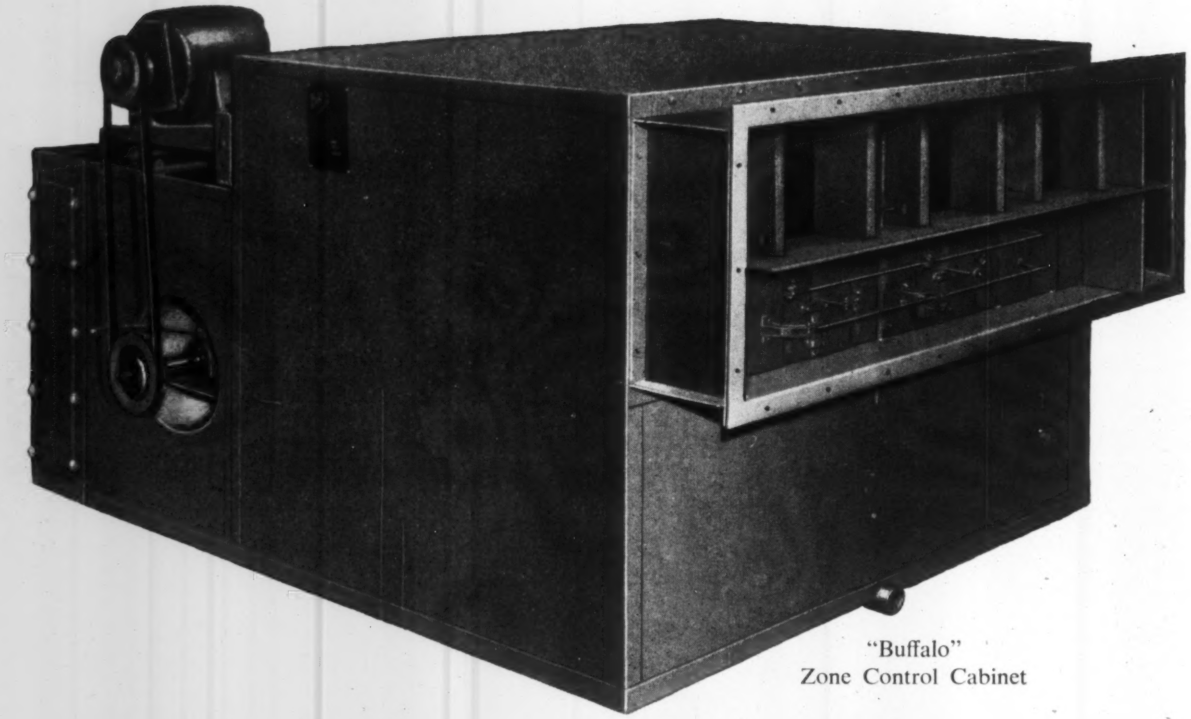
CONNOR... for Constant Comfort Conditions

Write—on your letterhead, please—for copies of "Air Conservation Engineering" and Dorex Bulletin 108A.

CONNOR
ENGINEERING
CORPORATION

dorex®
air recovery

CONNOR ENGINEERING CORPORATION • DANBURY • CONNECTICUT



"Buffalo"
Zone Control Cabinet

INDIVIDUAL ZONE CLIMATE CONTROL WITH THIS *ONE* VERSATILE CENTRAL CONDITIONING UNIT

This quiet operating unit provides each of many zones with the exact combination of air conditioning required, from a single, central source. Temperature is controlled by mixing cooled and heated air in the correct proportions to suit each conditioned space.

The need for separate re-heat coils and their controls is completely eliminated. Sectionalized design facilitates handling and installation. The entire unit is ruggedly constructed for a long life of maintenance-free operation.

Investigate the many advantages of "Buffalo" Zone Control Cabinets. Phone your "Buffalo" engineering representative, or write for Bulletin AC-220.

"Buffalo" products bring you the extra "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life.

"Buffalo"

BUFFALO FORGE

Buffalo Pumps Division, Buffalo, N. Y.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT

ENGINEERING FEATURES OF "BUFFALO" ZONE CONTROL CABINETS:

FAN SECTION — Fans are all aluminum for weight-saving, corrosion and spark resistance. Mixed flow wheels provide fully stable, highly efficient operation. Steep pressure characteristic minimizes variation in capacity and power. Streamlined housings are designed for low air velocities. Oversize hollow shafts are perfectly balanced and allow ample safety margin. Bearings are self-aligning, grease lubricated, ball type — externally mounted for convenient maintenance.

COIL SECTION — Unique design with coils mounted at an angle permits maximum coil face area with minimum headroom and length. One piece pan is all-welded heavy gauge sheet, with rigid structural frame covered on inside with corrosion-resistant insulating compound.

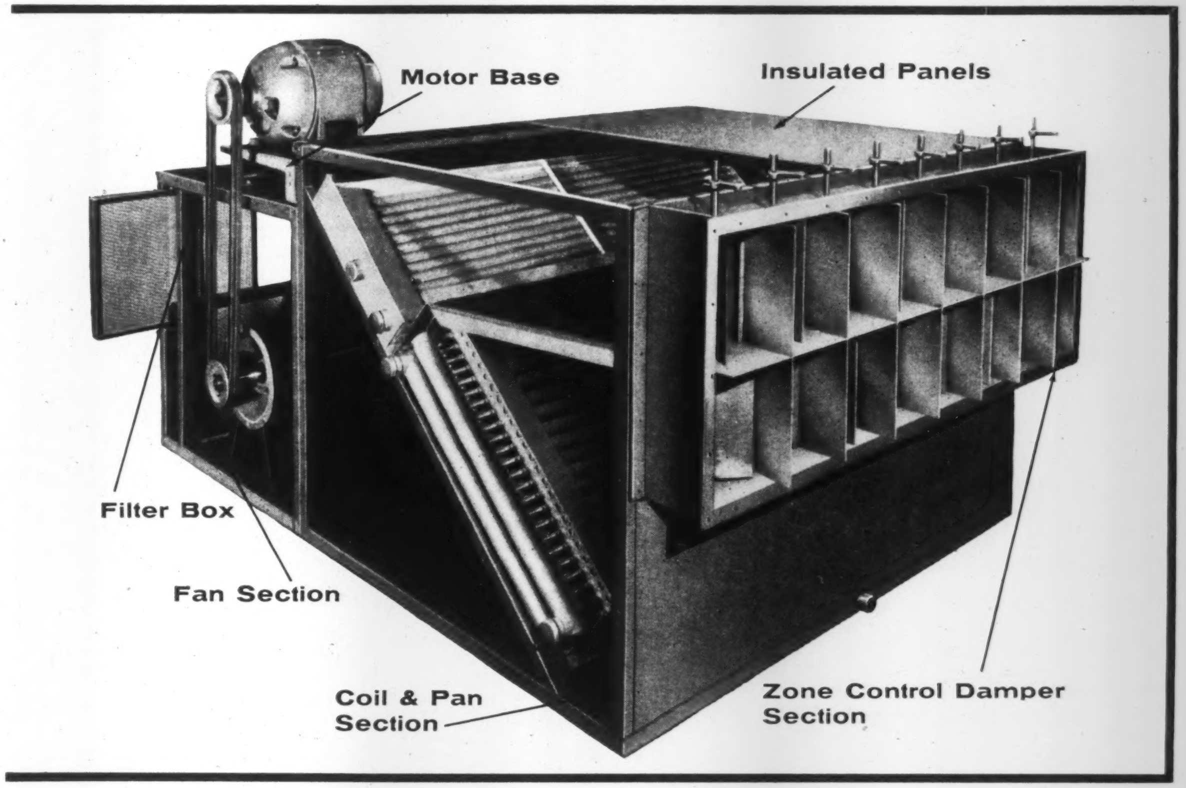
ZONE DAMPERS — Easily-removable, heavy gauge, all-welded frame and divider sheets. Blades are die-formed for stiffness and tight fit. Each zone has blade stops and extended shaft for damper control. Optional horizontal or vertical up-discharge permits minimum space without need for expensive discharge elbow.

FILTER BOX — Space-saving filter box is built into the fan section. Filters are easily replaceable.

MOTOR BASE — Completely adjustable for proper belt tension and different motor frame sizes.

INSULATED PANELS — Heavy sheet steel panels are insulated with ½" fiber glass.

ACCESSORIES — Filter boxes — either parallel type for low velocity cells, or flat type for high velocity cells. Mixing box either standard or combination style. Face dampers, or face and by-pass type. Humidifiers are steam grid or spray type. Resistance plate is either fixed or variable.



COMPANY, BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

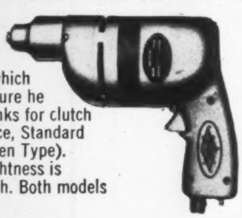
CERTIFIED SIOUX POWER

Electric Drills

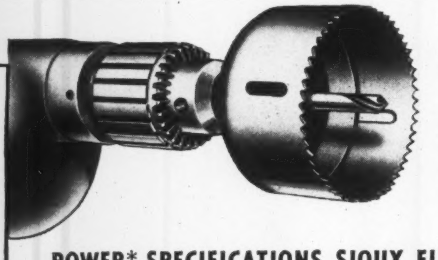
POWER
SIOUX

SIOUX ELECTRIC SCREWDRIVERS

NO. 260 — 262
On No. 260 Super Screwdriver the operator controls the tightness with which a screw is set by the amount of pressure he applies. The ¼" Hex Drive takes shanks for clutch head screwdriver bits, Reed and Prince, Standard screws, Phillips, and socket head (Allen Type). On the No. 262 Super Screwdriver tightness is pre-determined by adjusting the clutch. Both models equipped with reversing switch.

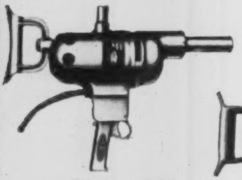


NO. 242
It fits the hand, and operates in restricted space like no other electric screwdriver. It quickly drives or removes all types of screws. No. 242 has a positive clutch; the operator controls the tightness by the amount of pressure applied. No. 246 has an adjustable clutch, so that it can be preset for any uniform degree of tightness desired.



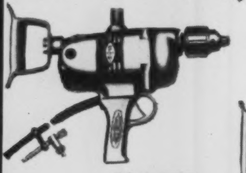
SIOUX HIGH-SPEED STEEL TEETH HOLE SAWS

will cut holes from ⅝" to 6" in diameter, in any free machining material to a depth of 1⅛". Alloy or stainless steel may be cut at slow speed. High-Speed teeth welded to chrome-vanadium body give maximum life and cutting ability.

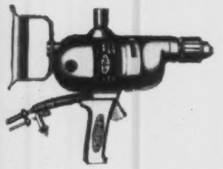


1" H.D. DRILL No. 1579

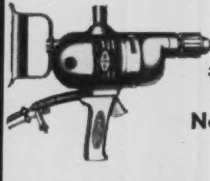
⅝" & ¾" H.D. DRILLS No. 1560, 1575



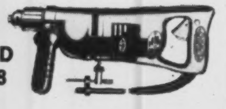
½" H.D. DRILL No. 1550



½" STD. DUTY DRILL No. 1510



⅜" & 5/16" H.D. DRILL No. 1517, 1519



½" SLOW SPEED DRILL No. 1548

POWER* SPECIFICATIONS SIOUX ELECTRIC DRILLS

When it's a SIOUX you know what it will do

Catalog Number	No Load Speed	H.P. and R.P.M. at Load Speed		Oz. Ft. Torque at Load Speed	H.P. and R.P.M. at Peak Load Speed		Oz. Ft. Torque Peak Load
1475	2250	5/64	1525	4.9	7/64	1050	8.8
1480	1600	7/64	1140	7.9	5/32	790	16.8
1485	1650	3/32	1060	6.9	1/8	620	16.7
1495	1650	3/32	1060	6.9	1/8	620	16.7
1498	400	3/16	275	45.0	9/32	215	108.0
1510	525	27/64	370	95.0	39/64	230	222.0
1517	925	13/32	670	49.0	9/16	540	135.0
1519	1250	13/32	860	37.5	9/16	500	96.0
1525	1650	5/16	1060	31.0	3/8	680	45.0
1541	925	13/32	670	49.0	9/16	540	85.0
1548	525	27/64	370	95.0	39/64	230	222.0
1550	525	7/16	325	108.0	17/32	175	252.0
1560	400	9/16	260	175.0	3/4	155	400.0
1575	400	3/4	205	308.0	1-1/8	125	748.0
1579	350	49/64	200	315.0	1-9/64	115	800.0
1472	1600	13/64	960	17.8	17/64	720	32.4
1473	950	13/64	575	31.6	17/64	430	55.0
1474	625	13/64	375	44.6	17/64	280	84.2
1477	950	13/64	575	31.6	17/64	430	55.0
1478	625	13/64	375	44.6	17/64	280	84.2
1479	1600	13/64	960	17.8	17/64	720	32.4

*for complete specifications

SEE THE NEW SIOUX CATALOG

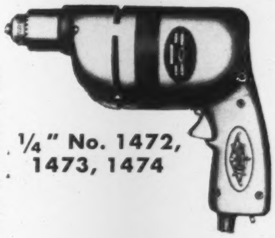
when it's a SIOUX

You know what it will do!

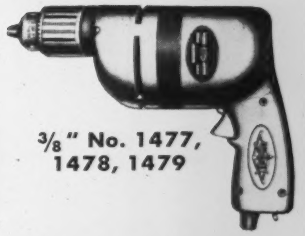
The Horsepower and torque for each SIOUX drill is rated, stated, and certified. It isn't necessary to buy just a drill. When it's a SIOUX you know what it will do. See the power specifications for SIOUX Electric Drills in this advertisement.

NEW *Super Powered* 1/4" and 3/8" DRILLS!

Here is super power to provide all the torque necessary for any operation where this type of drill would normally be used. (See specifications) And there's a speed for every need. It's an entirely new design in which the brushes have been located at the fan position at front of the drill. The advantages include cooler running, and easier inspection and replacement of motor brushes without partial or complete disassembly of the tool. Ball and roller bearing construction, with finest precision gears and mechanical design have achieved a new high in output efficiency.



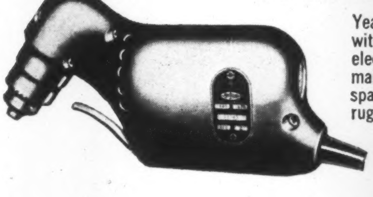
1/4" No. 1472, 1473, 1474



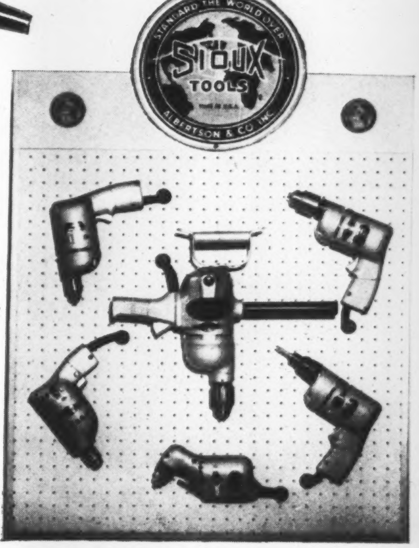
3/8" No. 1477, 1478, 1479

All time sales champ

The SIOUX No. 1495 1/4" ALL ANGLE DRILL

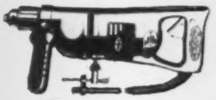


Year after year this is a top seller in the SIOUX line. It's popular with almost everyone—auto mechanic, sheet metal worker, electrician, shipbuilder, woodworker, assembly line, factory maintenance man. It fits the hand and operates in restricted space like no other tool. It's a most convenient handful of rugged power.



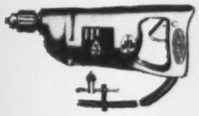
Leading distributors everywhere display and sell Certified **SIOUX** *power drills.*

AUTHORIZED SERVICE AND DISTRIBUTORS IN PRINCIPAL CITIES



3/8" H.D. DRILL No. 1541

1/4" H.D. DRILL No. 1525 BALL BEARING



1/4" H.D. DRILL No. 1480 SEMI BALL BEARING

1/2" LT. DUTY DRILL No. 1498

1/4" DRILL No. 1485

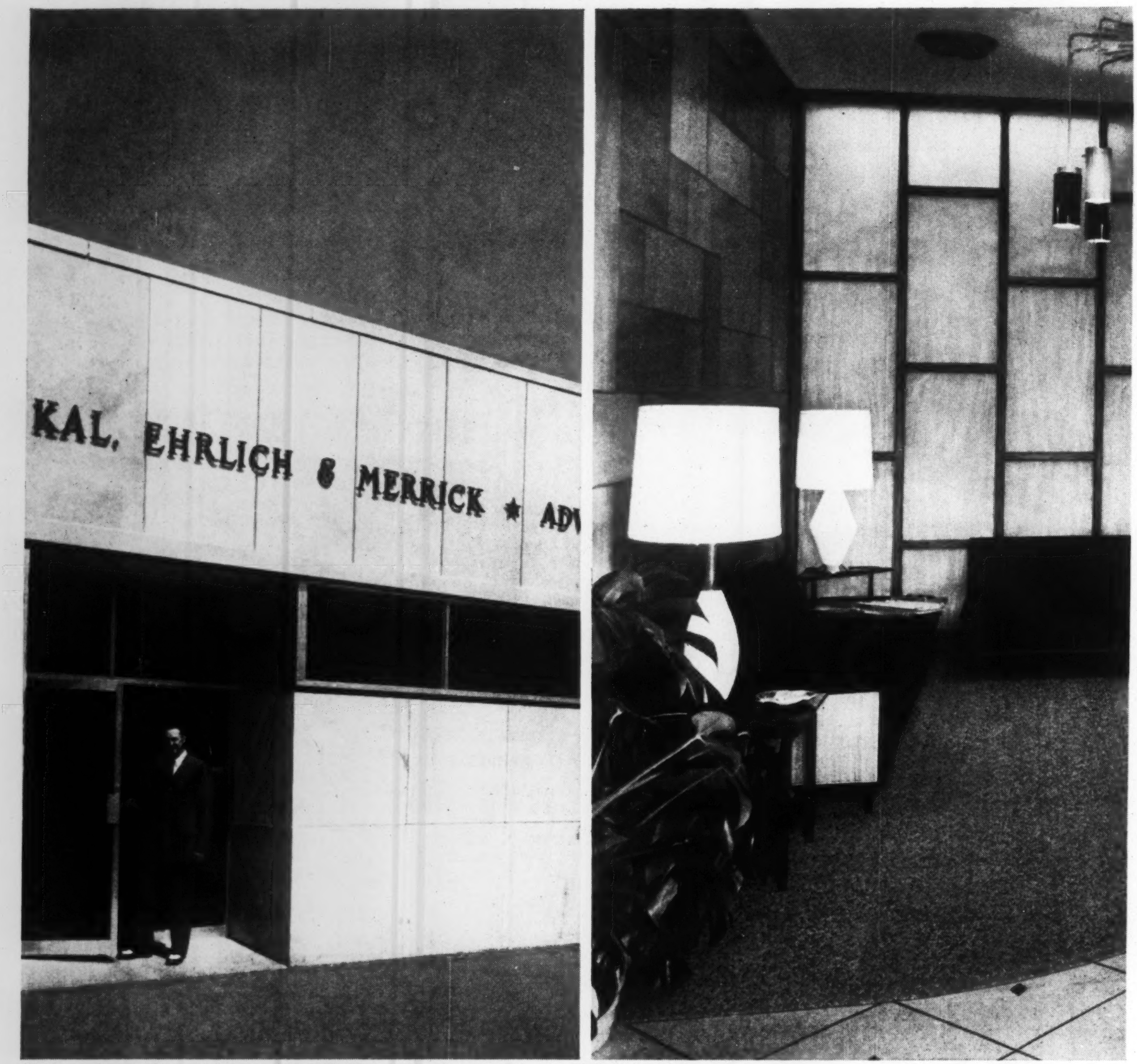
1/4" DRILL No. 1475

SIOUX

ALBERTSON & CO., INC.

SIOUX CITY, IOWA, U. S. A.

AIR IMPACT WRENCHES • AIR SCREWDRIVERS • "PELICAN" NUT ACCUMULATORS • ELECTRIC IMPACT WRENCHES • DRILLS • GRINDERS • SANDERS • POLISHERS • VALVE FACE GRINDING MACHINES • SCREWDRIVERS • PORTABLE SAWS • FLEXIBLE SHAFTS • ABRASIVE DISCS



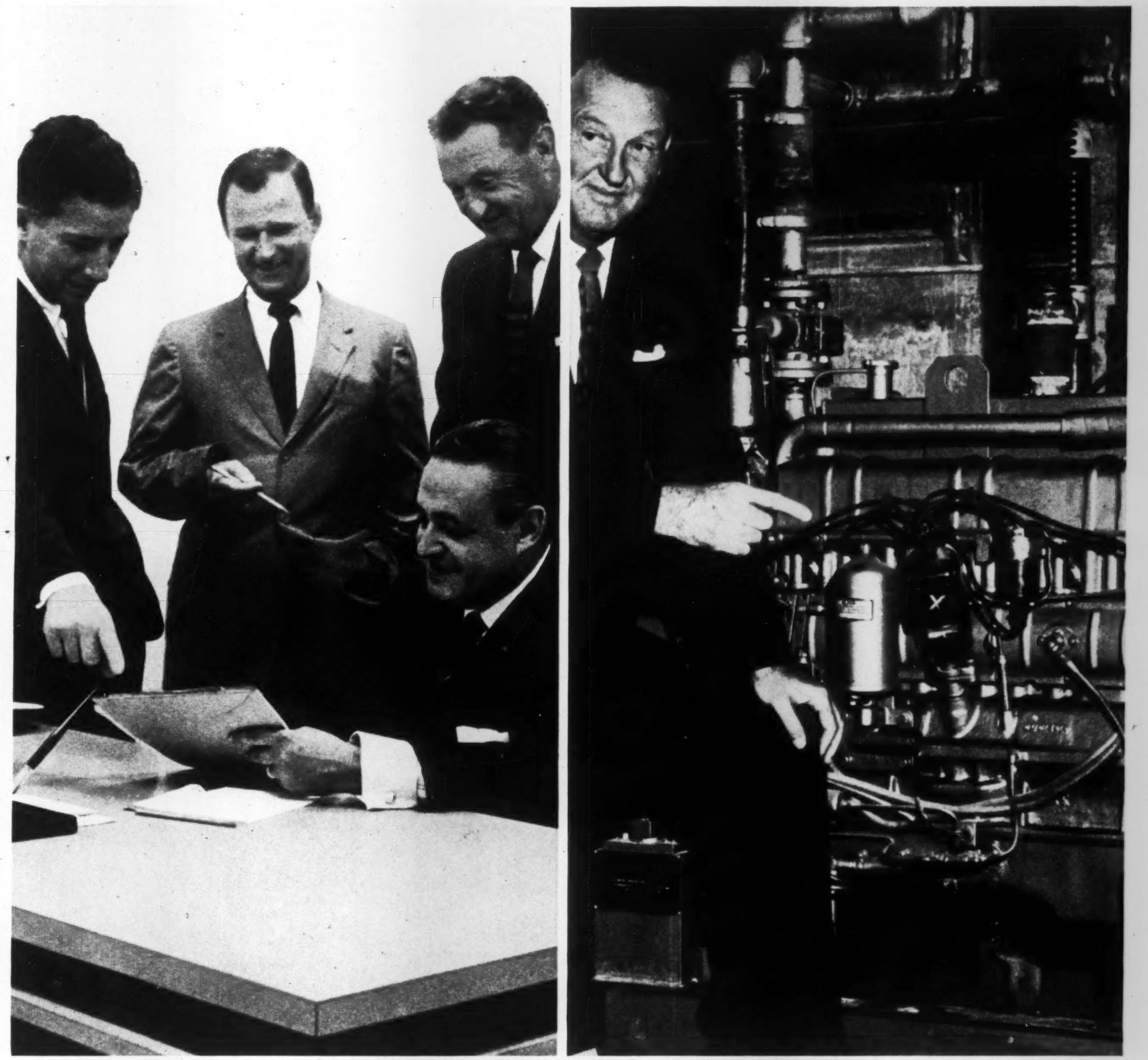
Modern air-conditioned home of Kal, Ehrlich & Merrick, Washington, D.C. advertising agency

"Nothing to do—but enjoy it, with our all-

Says Harry L. Merrick, Sr. President,
Kal, Ehrlich & Merrick Advertising Agency

"Only the best air conditioning system would do for our new building, and experience proves the best is definitely gas", continues Mr. Merrick. "Our Ready-Power air conditioner gives us the exact climate control we want every day of the year . . . and it's extremely inexpensive to operate."

Ready-Power's exclusive variable speed operation offers *constant, precise* control of humidity and temperature without the variations common to on-off systems.



Gas-operated unit provides exact climate control, adds to the efficiency of agency's creative people.

year READY-POWER GAS air-conditioning!"

Because they combine the outstanding economy of gas fuel with automatic metering to match the load on hand, Ready-Power units have the lowest known operating costs . . . *less than a penny per ton per hour!*

For information on how you can benefit by installing modern Gas air conditioning equipment, call your Gas Company's commercial specialist or write to the Ready-Power Company, Detroit 14, Michigan. *American Gas Association.*

How to cut costs with the RIGHT motor

Don't be baffled by power factors, torques, efficiencies, and starting, accelerating, and thermal characteristics, or housing, horsepower and speed control. Let Century Electric help you balance these factors to cut operating costs with the *right* motor.

Here's how Century Electric can help you:

10,000 choices—Century Electric engineers can help you specify the right motor without having to rely on a few types to do all jobs. Century Electric makes a complete variety of integral horsepower motors. Over 10,000 types up to 400 hp. There is one for every type of equipment—transfer machines, ball mill drives, compressors, drilling machines, lathes, etc. For all operating conditions too—dusty, corrosive, explosive or moist.

Long life motors—And you get years of dependable operation from Century Electric motors. They are manufactured to rigid quality standards. Electrical tests and other checks on operating characteristics made during manufacture assure you the best motor for your money.

Application know-how—Every Century Electric sales engineer knows motor drive systems because he sells motors and nothing but motors. Often he can give you on-the-spot answers. If not, he can turn to an engineering staff that comes up with quick answers.

You can get the right motor for your equipment just by contacting your nearest Century Electric Sales Office or Authorized Distributor. A Century Electric sales engineer will be glad to help you.

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

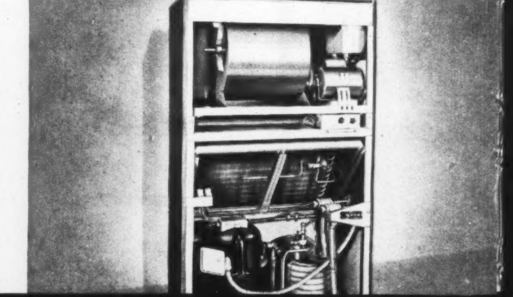
58-22

New models, new sizes, Trane Self-Contained

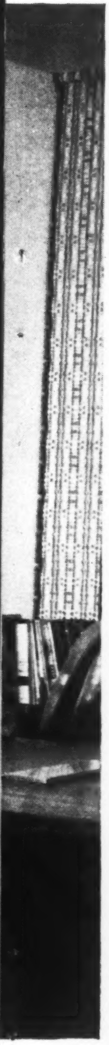
Air-cooled condenser (available for all sizes) features new, smaller dimensions, simplified piping and wiring for easy installation. Water-cooled condensers (all sizes) and evaporative condensers (10 through 20-ton sizes) also available.

Simplified construction speeds installation and service! All components of these new Climate Changers are easily accessible from front. Refrigeration cycle is easily removable for inspection, service on the job—or for in-shop repair or exchange.

Improved "iso-sound" design assures quiet, vibration-free operation. Cabinet and compressor housing completely insulated. Deluxe units may be installed in the conditioned space without disturbing occupants or employees.



new styling for Climate Changer Units



3 to 30-ton packaged units — air or water-cooled — are easier to install, easier to service

Here's the new line-up of TRANE Self-Contained Climate Changers for 1959: new air or water-cooled units in a complete range of sizes from 3 to 30 tons. And they're beauties! New, modern styling, clean, classic lines, smaller dimensions make them blend with today's office and store design. And, of course, these new units are engineered to the same rigid specifications that have made TRANE a leader in big building air conditioning systems. They're easy to install, too, with just a few simple piping and wiring connections. Extra rugged construction makes them easy to ship and to handle on the job. So for your next "packaged" cooling job, make it a TRANE Self-Contained Climate Changer! Call your nearby TRANE Sales Office for complete facts on these new Climate Changer units—or write directly to TRANE, La Crosse, Wisconsin.

CHECK THESE FEATURES:

- **Easy to install**—Smaller dimensions for easy handling. Internal wiring completed, with low voltage circuit that's easier, safer to work with. Readily accessible water piping connection (on water-cooled models). Sturdy construction, with components mounted on independent frame . . . no strain on external cabinet.
- **Easy to service**—All components easily accessible from front panel. Removable refrigeration cycle can be serviced in field, or entire unit may be easily removed for in-shop repair or exchange.
- **Streamlined appearance** — Modern lines and new design blend with office or store decoration. Equally well adapted for free-standing or recessed location. New decorative return air grille instead of conventional return air louvers. Low heights for balcony, roof or suspended installation.
- **Quiet operation** — New, large slow-speed fans with adjustable belt drive for extra quiet air movement. All moving parts isolated, with spring-mounted compressor that absorbs vibration. Casing insulated throughout.
- **Flexibility**—Complete range of sizes, types. Water-cooled, air-cooled and evaporative condenser models. 3 to 30-ton capacities. Both vertical and horizontal rear discharge available by simple on-the-job fan rotation. Large, efficient fans with larger h.p. fan motors give full air capacity—even with long duct runs.

For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING,
HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

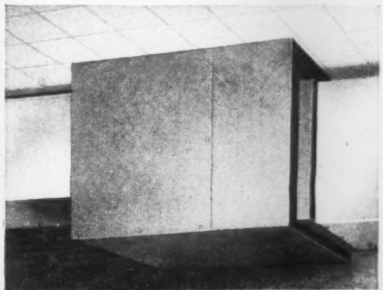
THE TRANE COMPANY, LA CROSSE, WIS.
SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 97 U. S. AND 19 CANADIAN OFFICES

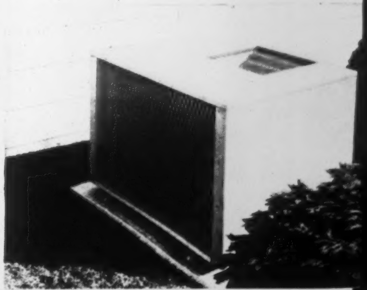
There's a Trane Climate Changer unit to cool any home, store or office!

Heat and cool with this new Climate Changer combination unit. Warm air furnace in both oil and gas-fired models . . . complete range of sizes and types. Cooling section available in 2, 3 and 5-ton capacities.

Save space with this compact Fan-coil Climate Changer! Tucks away in attic, closet, utility room—or may be installed behind partition or under ceiling. Provides crisp, cool air for store, home or office. 2, 3 or 5-ton.

No water needed! These TRANE Climate Changers are air-cooled, eliminating water supply and disposal problems. Compact condensing unit is located outside the home or building.

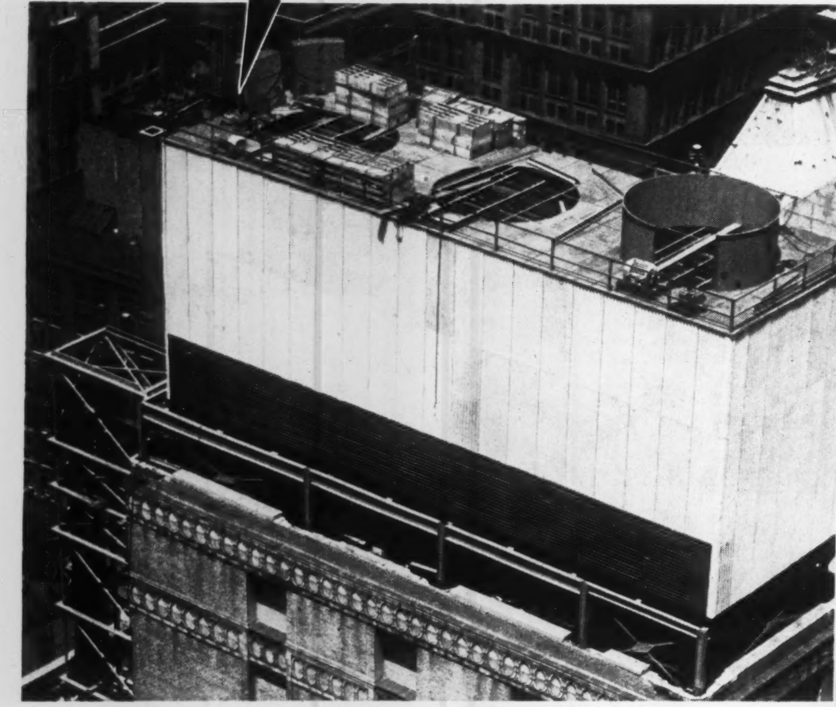




Here's how Phillips solves

another problem solved by Phillips

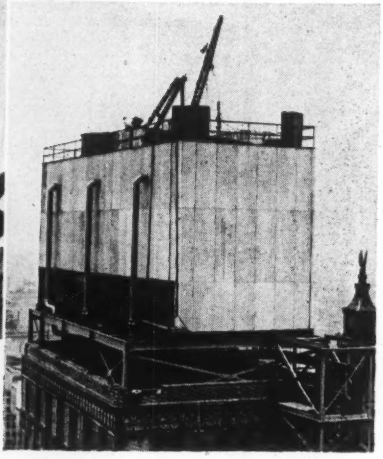
CUSTOM ENGINEERED
COOLING TOWERS



18-20 PINE ST. BLDG.
NEW YORK, N. Y.

Consulting Engineer:
Ebner Associates
New York, N.Y.

Mechanical Contractor:
Wolff & Munier-Courter
New York, N.Y.



The problem:

To get maximum cooling in a limited roof area under adverse construction conditions (40 stories above the street).

The solution:

PHILLIPS CUSTOM ENGINEERED COOLING TOWER with framing dimensions specially designed to use all available roof area for cooling. Tower framing also reinforced to support hoisting rig as there was no other method of getting materials and equipment to roof.

Result: A complete, efficient cooling tower at economical cost in minimum time.

cooling tower problems CUSTOM ENGINEERING

Whatever the problem — noise . . . freezing . . . space . . . maintenance . . . atmospheric conditions — you'll find PHILLIPS CUSTOM ENGINEERED COOLING TOWERS solve the problem better . . . at less cost. Why? Because here are the only cooling towers that are custom engineered to suit the conditions of each application. No wonder each year, more and more specifications call for PHILLIPS CUSTOM ENGINEERED COOLING TOWERS.

EVERY STEP CUSTOM ENGINEERED

CASINGS
Selection of material to fit Architectural treatment and surrounding conditions.

BASINS
Redwood, stainless steel, galvanized steel, carbon steel up to and including ¼" thickness with any desired coating, reinforced concrete basins supported on steel beams.

FILL
Redwood or pressure treated Douglas Fir. Slip-fit, self-supporting for easy removal for interior maintenance.

FANS
Multi-blade, adjustable propeller type fan in cast aluminum, stainless steel or Monel. Either direct driven fan in small sizes or indirect right angle worm gear drives.

DISTRIBUTION SYSTEM
Spray nozzle type or open Weir gravatational type system.

FRAMEWORK
Hot dipped galvanized structural steel .250" minimum thickness. Redwood or pressure treated Douglas Fir.

Write for literature

SPECIAL FEATURES ON ALL TOWERS

Corrosion Resistant Hardware. Aluminum or Stainless Steel Fans. Nailless Redwood Filling Removable at Tower Base. Nailless Three-Pass Redwood Eliminators. Removable Louvers.

Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N.Y.

DEPENDABLE PERFORMANCE
the mark of
ROBERTS
GORDON
BYDAND
GAS BURNERS!

Roberts-Gordon Power Multuri Gas Burner Capacities: 700,000 - 19,600,000 BTU. Ideally suited to large installations.

Roberts-Gordon Multuri Atmospheric Gas Burner Capacities: 700,000 - 9,450,000 BTU. Extremely quiet operation.

- **Universal Adaptability!**
- **Built-In Dependability!**
- **Easy to Install!**
- **Minimum Maintenance!**
- **All Components Readily Accessible for Routine Servicing!**
- **Packaged Units, Factory Wired and Completely Assembled!**

Your reputation as a heating expert is at stake every time you recommend and install a gas burner. You protect that reputation and add to your prestige when you select these famous Roberts-Gordon Multuri Gas Burners for your commercial and industrial installations.

Every last detail of advanced design of these Roberts-Gordon Multuri Gas Burners assures top efficiency and the very minimum of service costs.

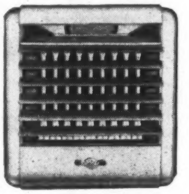
Don't be tempted to put in something less. Get DEPENDABLE PERFORMANCE. Install famous Roberts-Gordon.

Custom Engineering Service

In addition to standard Multuri Burners (capacities above) larger units or specially-designed burners can be supplied to fit your needs. No problem is too big or too specialized — Roberts-Gordon offers the finest Custom Engineering Service to meet your needs.

Get the facts now. You'll be 'way ahead when you install famous Roberts-Gordon Gas Burners.

Write for name of nearest factory representative. Sales and service coast-to-coast in U. S. and Canada.



ROBERTS-GORDON
"Spreader-Flame"
Gas Fired UNIT HEATERS

- Compact!
- Fast Heating!
- Lightweight!
- Economical!
- Quiet, Efficient Operation!

Aluminized steel heat exchanger with all welded tubes assures long, trouble-free life.

Roberts-Gordon
APPLIANCE CORP.

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Get positive piping protection with

ZALLEA NON-EQUALIZING EXPANSION JOINTS . . .

Zallea Non-Equalizing Corrugated Expansion Joints offer a degree of protection that can't be equalled for absorbing movement of piping due to temperature changes. They protect interconnected equipment by absorbing movements in otherwise rigid piping systems. They are used in low pressure and vacuum lines . . . between stills, tanks, columns, condensers, pumps and similar equipment.

Standard Sizes: 3″ to 72″ dia.; Special sizes to 50 ft. dia. Pressures: Vacuum to 50 psig Temperatures: to 1600°F.

Special Applications. With the addition of proper components, Zallea Non-Equalizing Expansion Joints can be used as:

Universal Expansion Joints to absorb movement in any direction . . . axially, laterally, angularly, or any combination of these.

Pressure Balanced Expansion Joints to absorb axial movement outside the unit and still carry pressure thrust.

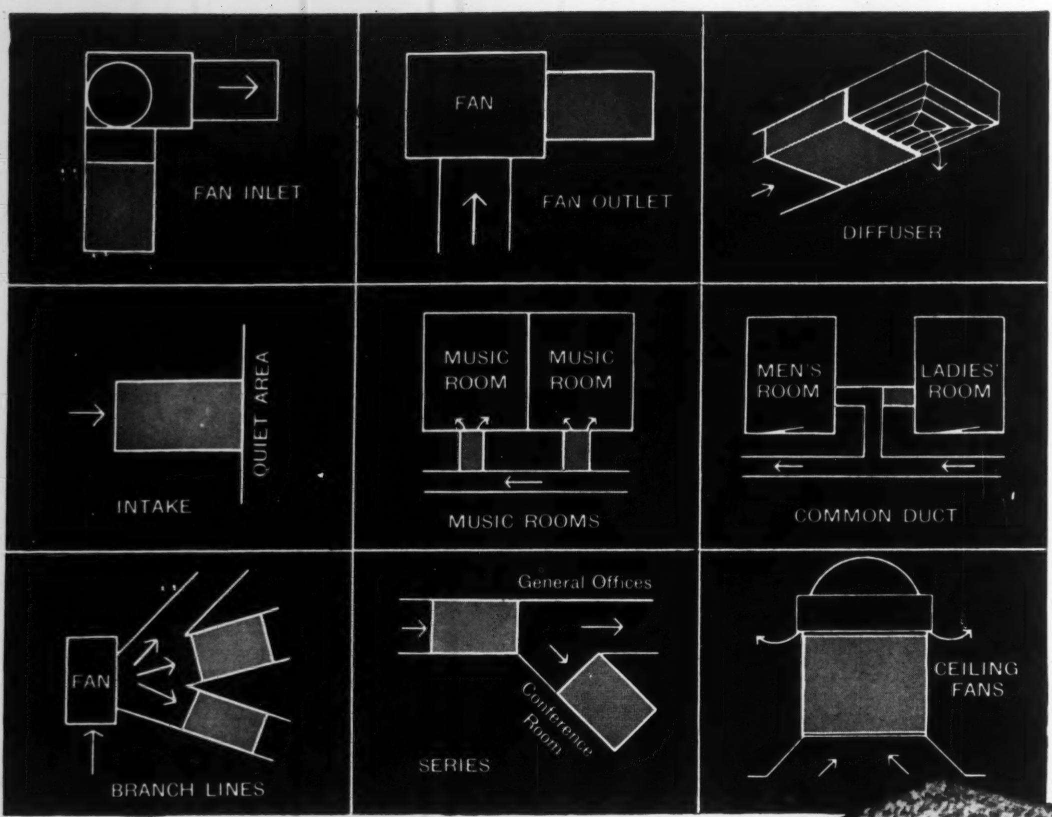
Hinged and Gimbal Expansion Joints for piping systems that cannot be anchored in the conventional manner.

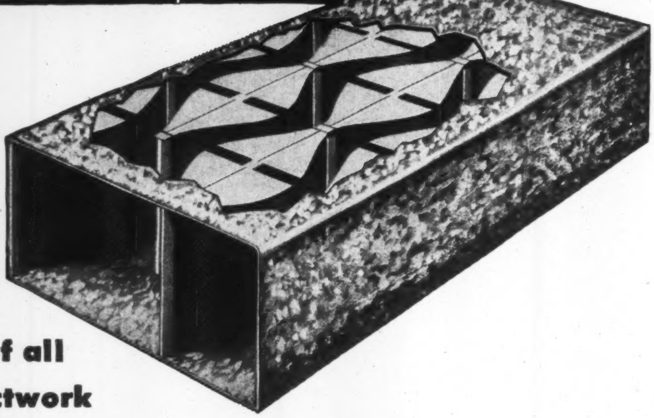
Get the complete story of Zallea Expansion Joints in our new 72-page manual. They are available for any pressure condition to 3600 psig. Write, on your company letterhead, for your copy of Catalog 56.

Zallea
expansion joints

Zallea Brothers • Wilmington 99, Delaware
World's largest manufacturers of expansion joints

Large Zallea Non-Equalizing Expansion Joint installed on deaerating heater of Ford Motor Company's River Rouge plant.


FAN INLET
FAN
FAN OUTLET
DIFFUSER
QUIET AREA
INTAKE
MUSIC ROOM
MUSIC ROOM
MUSIC ROOMS
MEN'S ROOM
LADIES' ROOM
COMMON DUCT
FAN
BRANCH LINES
General Offices
Conference Room
SERIES
CEILING FANS



Every Building Needs *Aircoustat* Sound Traps

AIRCOUSTAT silences all noise of all frequencies traveling through ductwork

Eliminate disturbance, distraction and irritation caused by noises escaping from one area to another through ductwork.

Install AIRCOUSTAT Sound Traps. AIRCOUSTAT eliminates guesswork, wasted space and unnecessary expense of duct lining. You can guarantee your client trouble-free performance. You can estimate with complete confidence the performance of particular applications. If AIRCOUSTAT fits geometrically, it fits acoustically.

AIRCOUSTAT saves you space. Its greater effectiveness permits smaller-sized ducting. It eliminates bulky mufflers.

For more details, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 3403 Scott Street, Baltimore 3, Md.

KOPPERS

INDUSTRIAL SOUND CONTROL

Engineered* Products Sold with *Service

Honeywell announces a major scientific breakthrough---the **ULTRAVIOLET SENSOR**

NEW FLAME SENSOR POSITIVELY DIFFERENTIATES BETWEEN FLAME AND HOT BRICK

Honeywell development utilizes invisible ultraviolet rays to revolutionize safety standards in detection devices.

Honeywell's New Ultra-Vision* Flame Detector, C7012A

*Trademark

An ultraviolet-sensitive tube about the size of an index finger now solves all your flame sensing problems, including refractory override and hold-in.

Developed by Honeywell, the C7012A Ultra-Vision tube is the only sensor that can tell the difference between real flame and red-hot firebrick so that raw fuel delivery is stopped immediately in the absence of flame. It also eliminates nuisance shutdowns occurring when refractory glare masks out the flame.

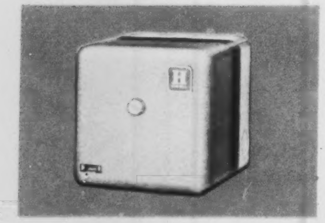
Multiple-burner installations are greatly simplified since the Ultra-Vision tube, being insensitive to the refractory, can be aimed directly at the flame in any convenient way —the sensor will detect a flame from any type of fuel.

The C7012A ultraviolet sensor will bring revolutionary new safety to gas and oil burners. For complete information call your local Honeywell office, or write Honeywell, Minneapolis 8, Minnesota.

The Ultra-Vision Flame Detector will work with all Honeywell rectification relays ⟶

MATCH YOUR JOB REQUIREMENTS WITH THE MOST COMPLETE LINE OF BURNER CONTROLS IN THE INDUSTRY

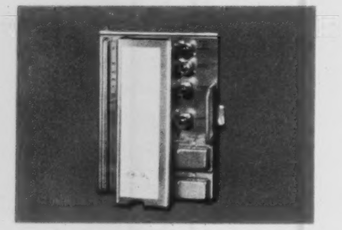
New U.L. requirements mean stack relays can no longer be used on commercial burners of more than seven-gallon size. You can meet *all* requirements by choosing Honeywell, now offering the most complete line of Electronic Combustion Controls with exclusive Safety Start.



FOR MEDIUM BURNERS— RA890C PROTECTORELAY*

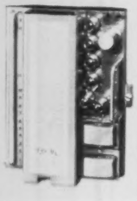
The RA890C is a basic rectification relay ideally suited for use with the new C7012A Ultra-Vision sensor, as well as with flame rods or photocells. It's designed especially for pressure-gun oil burners, small combination gas-oil burners and gas power burners.

*Trademark



FOR LARGE CONVERSION BURNERS— R478 PROTECTORELAY

Here's an electronic programming relay for large horizontal rotaries, combination gas-oil burners, steam-atomizing burners and large power gas burners. The R478A may be used with the C7012A Ultra-Vision sensor, flame rods or photocells. The R478B is available for use with lead-sulphide cells.



FOR MEDIUM-SIZE COMMERCIAL BURNERS— R4074B PROTECTORELAY

In applications where the extra flexibility of the R478 (above) is not a requirement, the R4074B Protectorelay provides an economical programming relay for use with lead-sulphide flame detection systems.

Choose Honeywell—all types of controls for every possible combination!

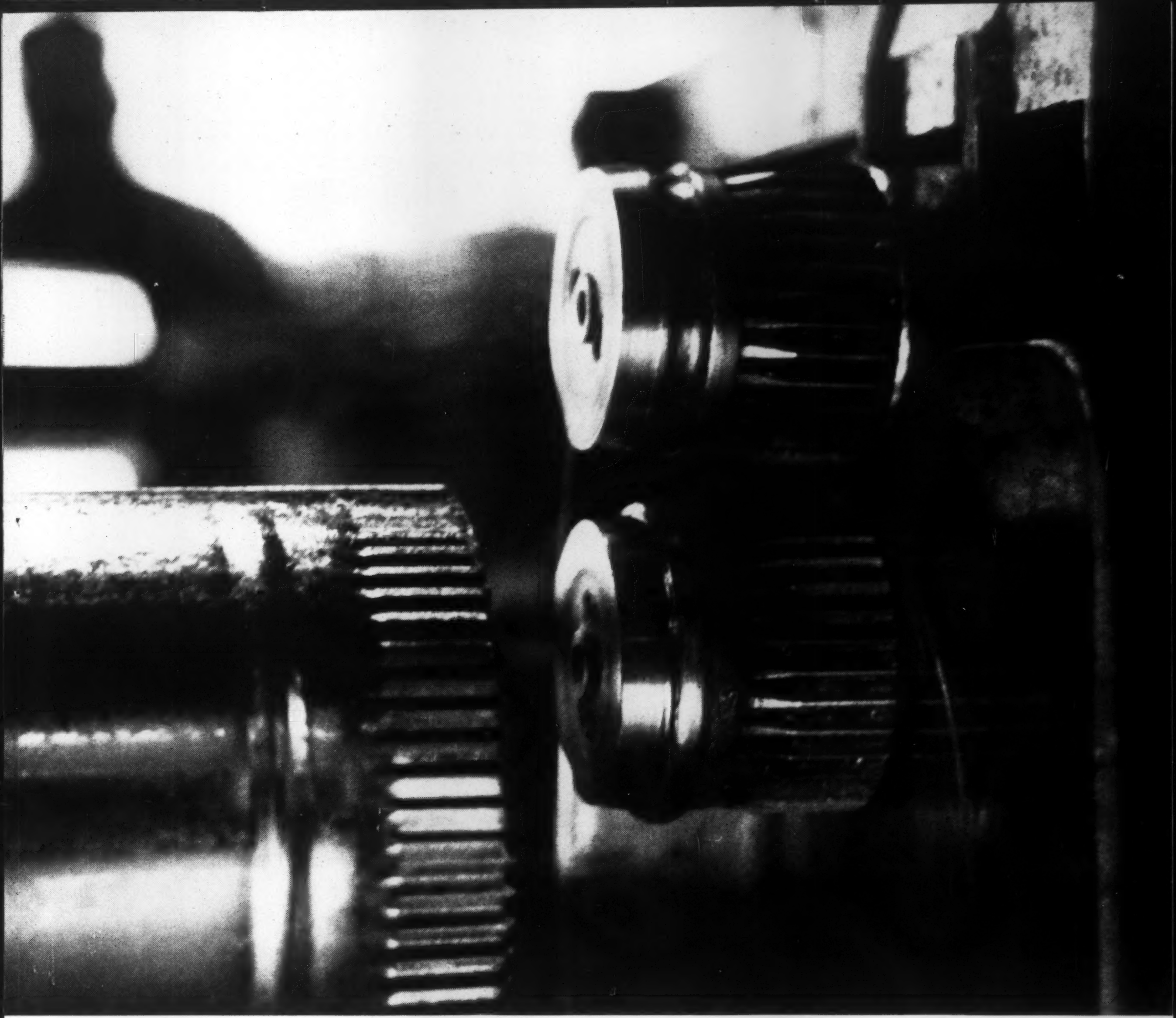
- Choice of flame detection
- Choice of burner sequencing
- Manual or automatic starting
- Wide range of voltages
- Fast detection and response
- Ease of installation
- Low maintenance costs
- Honeywell nationwide engineering and service

FOR MORE DETAILS, call your local Honeywell office—or write Minneapolis-Honeywell, Minneapolis 8, Minn.

Honeywell

H HONEYWELL *First in Control*

76-4786 Printed in U.S.A.



"NO REJECTS IN OUR SHOP! WE CRIMP CHIP-PROOF WEIRKOTE®"

See for yourself, as so many others have. Put zinc-coated Weirkote through its paces. Give it the business—the toughest, most tortuous jobs in the shop. Crimp it, bead it, twist it, spin it, draw it. Work it to the limits of the steel itself. Then take a close look.

Not a chip or flake mars its smooth zinc surface! And why should they? Weirkote's continuous process integrates zinc and steel so tightly that chipping and flaking do not occur and a new high in corrosion protection is assured.

Can you imagine what this means to repeated, top-notch production results? To the goodwill of your customers who will continually get the best finished products on the market? To your peace of mind, rid, at last, of annoying, costly rejects?

In spite of all these advantages, Weirkote's cost is low. One more good reason why you should write today for a free 12-page booklet that explains in detail how Weirkote can help you. Weirton Steel Company, Dept. M-8, Weirton, West Virginia.

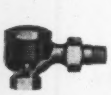
WEIRTON STEEL COMPANY

WEIRTON, WEST VIRGINIA

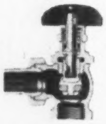
a division of

NATIONAL STEEL CORPORATION

Sarco
Type H
Radiator
Trap

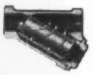


Sarco
Spring-Packless
Steam Radiator
Valve

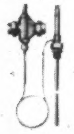


Sarco
Float-
Thermostatic
Steam Trap

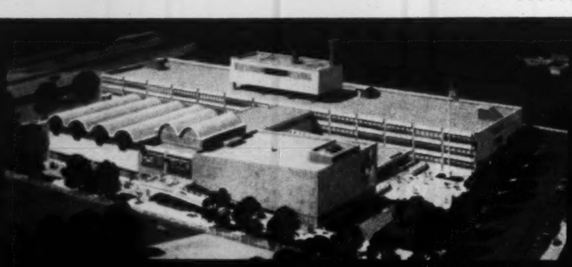
Sarco
SB Strainer



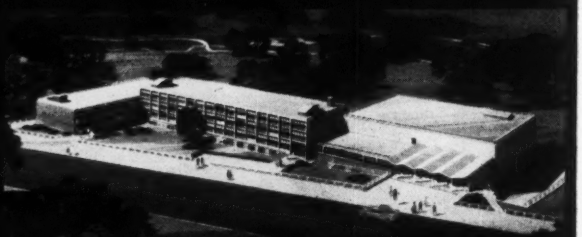
Sarco
TR 50-21
Temperature
Regulator



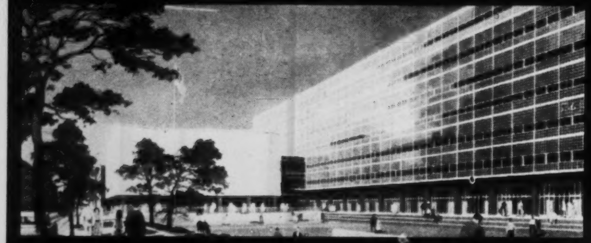
These Sarco Products give these New York City Schools reliable heating systems . . . economically



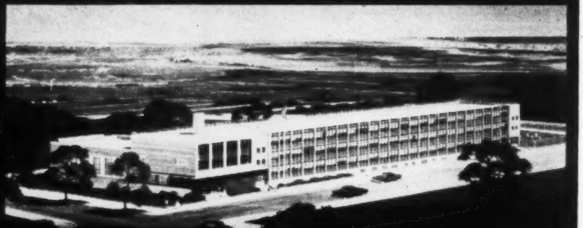
WILLIAM F. GRADY VOCATIONAL HIGH SCHOOL, New York. Katz, Waisman, Blumenkranz, Stein & Weber, Architects. Raisler Corporation, Heating Contractor. Benjamin L. Spivak, Engineer.



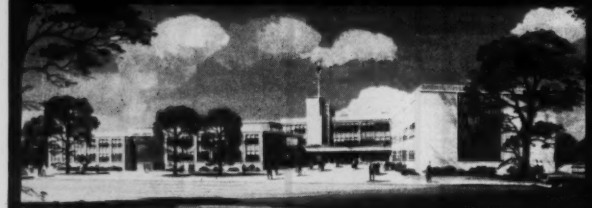
JUNIOR HIGH SCHOOL 142, New York. New York City Board of Education, Bureau of Construction, Architects and Engineers. Daniel J. Rice, Inc., Heating Contractor.



NEW YORK SCHOOL OF PRINTING, New York. Kelly & Gruzen, Architects. Afgo Engineering Corporation, Contractor. Jaros, Baum & Bolles, Engineers.



JUNIOR HIGH SCHOOL 211, New York. Lloyd Morgan & Eugene V. Meroni, Architects; Harry P. Jaenike, Associate. Daniel J. Rice, Inc., Heating Contractor.



SHEEPSHEAD BAY HIGH SCHOOL, New York. Holden, Egan Wilson & Corser, Architects. Raisler Corporation, Heating Contractor. Slocum & Fuller, Engineers.

In all five of these brand new schools, designed and constructed to the highest standards of the New York City Board of Education, all five of these Sarco products shown above are used to assure trouble-free heating systems. High-quality Sarco steam traps, valves, strainers, temperature controls, and other heating specialties assure dependable system performance — with extremely low maintenance costs.

FOR DETAILS on cost-saving temperature controls, steam traps, or heating specialties . . . or for engineering information . . . contact your Sarco-Sarcotherm sales representative, or write

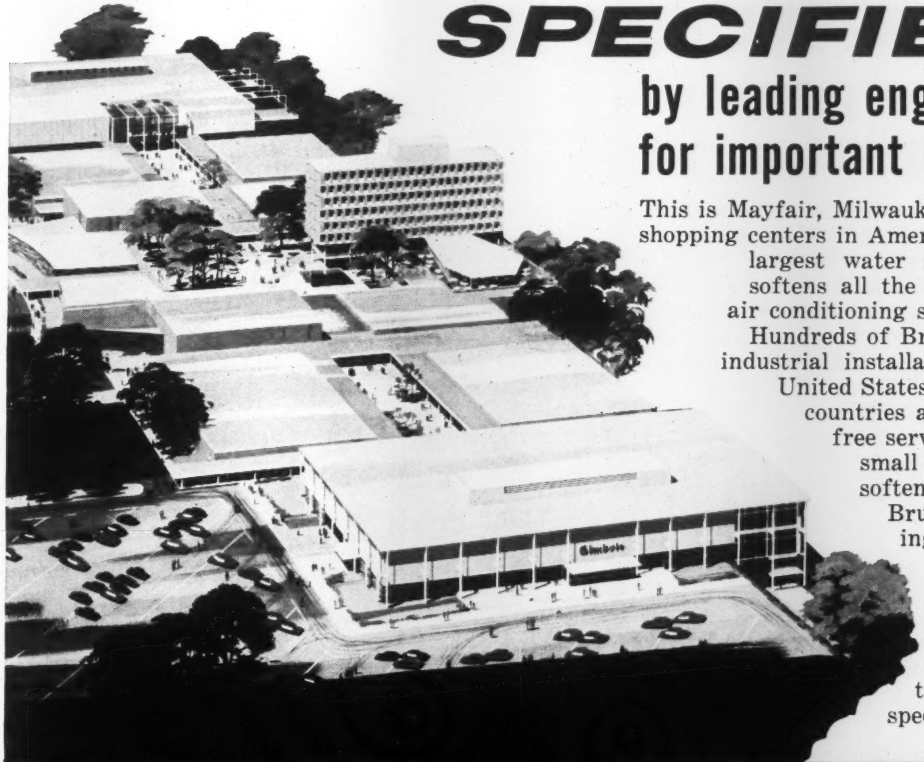
6692-B

SARCO
COMPANY, INC.
635 Madison Ave., New York 22, N. Y.

STEAM TRAPS • TEMPERATURE CONTROLLERS • STRAINERS • HEATING SPECIALTIES

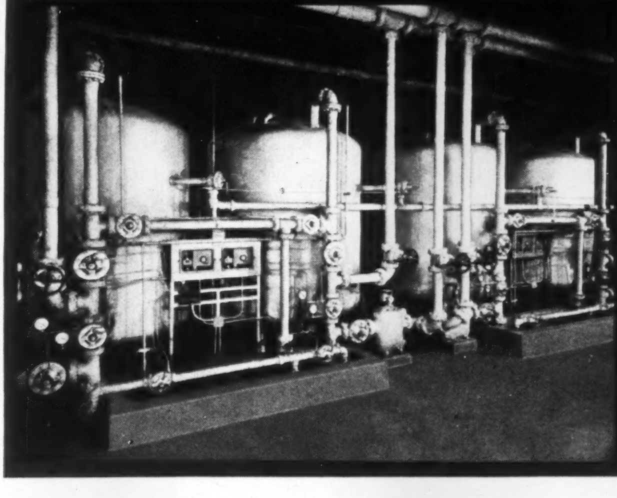
BRUNER Industrial WATER SOFTENERS

. . . are frequently SPECIFIED by leading engineers for important installations



This is Mayfair, Milwaukee, one of the largest shopping centers in America. One of Bruner's largest water softener installations softens all the water — even in the air conditioning system.

Hundreds of Bruner commercial and industrial installations throughout the United States and in many foreign countries are providing trouble-free service in both large and small applications. Water softeners, filters, and other Bruner water conditioning equipment are available for immediate delivery from stock in many types and sizes. Custom installations are fabricated to engineer's exact specifications.



The Bruner softeners at Mayfair are fully automatic. Salt storage and brining systems are specially designed. Softener capacity is 13,000,000 grains and delivers 1,750,000 gallons of softened water @ 1200 GPM.

Consulting Engineer: L. R. SCHMAUS CO., INC., Milwaukee, Wis.

Architect: GRASSOLD-JOHNSON & ASSOCIATES, Milwaukee, Wis.

Plumbing Contractor:
SEDLET PLUMBING & HEATING, INC.,
Milwaukee, Wis.

Automatic Industrial type softener carried in stock.

BRUNER CORPORATION
America's most complete line of quality water softeners and filters.
Executive Offices: 4763 N. 32nd ST., MILWAUKEE 9, WIS.
Telephone: HIlltop 2-3200
Plants: Milwaukee, Wis., and Los Angeles, Calif.
Sales and Engineering Offices in all principal cities.

it's all working filter area with a Green

ECON-O-ROLL*

AUTOMATIC AIR FILTER

With Green's unique design, each and every square inch of exposed media surface in ECON-O-ROLL works for you. None of the exposed media surface is ineffective.

ECON-O-ROLL also eliminates the problem of contaminated air leakage around the edges of the media, even while indexing, because of its exclusive free floating, self-adjusting seal assembly.

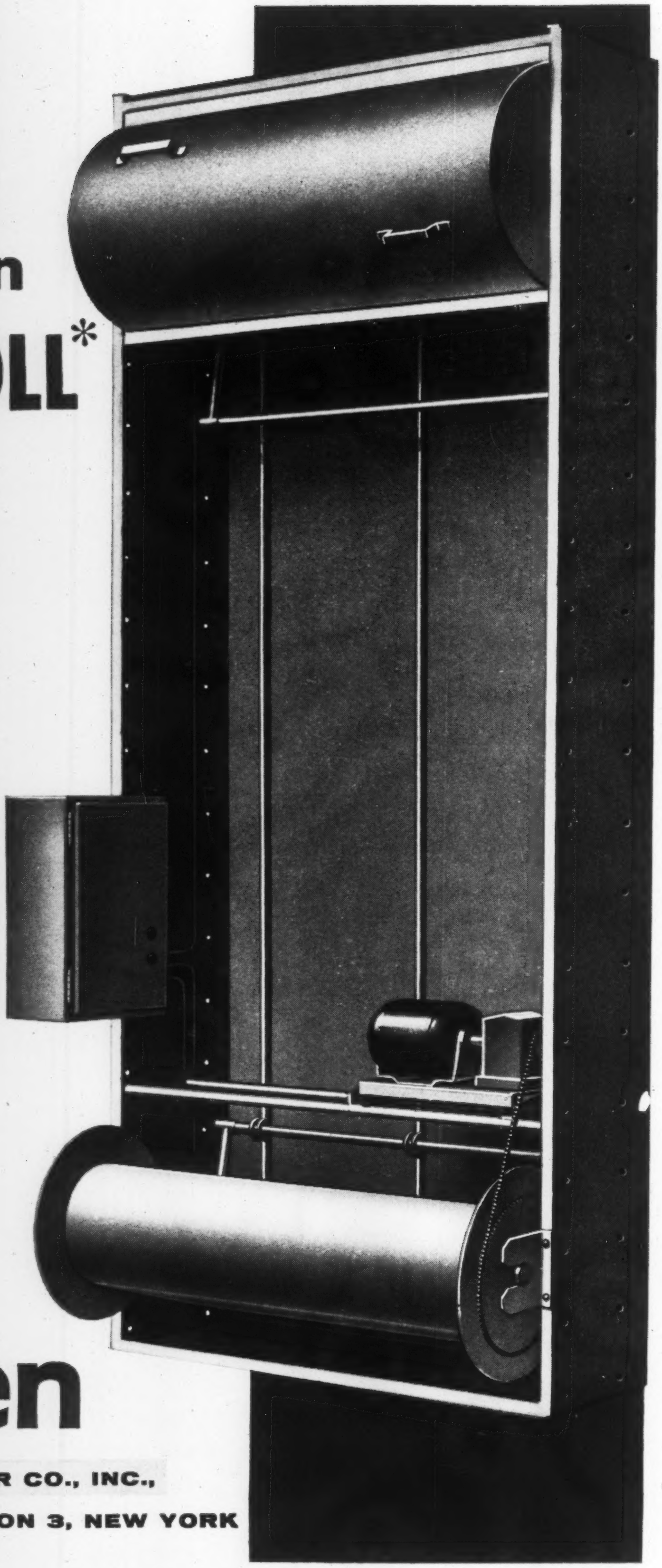
The automatic electrical control systems which are standard equipment with the ECON-O-ROLL, leave nothing to be desired. The control panels are completely wired, eliminating the need for costly job-site wiring. You have a choice of either a timer actuated system, or a system which is actuated by pressure differential. Both systems include a manual control push button, and an end-of-media switch with a warning light which signals the need of media replacement.

ECON-O-ROLL arrives on the job completely assembled and installation is accomplished with ease, because of its basic, simple design.

Why not investigate the merits of the ECON-O-ROLL filter? There is a size to fit your needs.

Simply write for Bulletin 176.

*U.S. Patents Pending

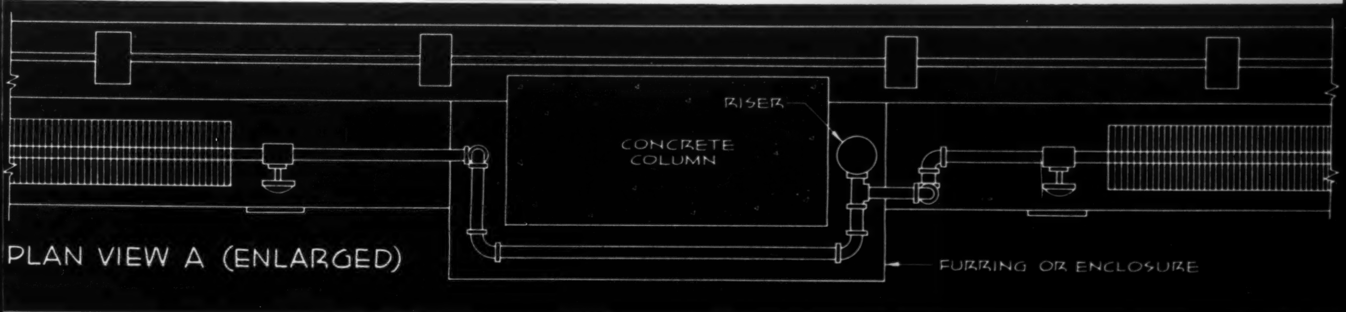


Green

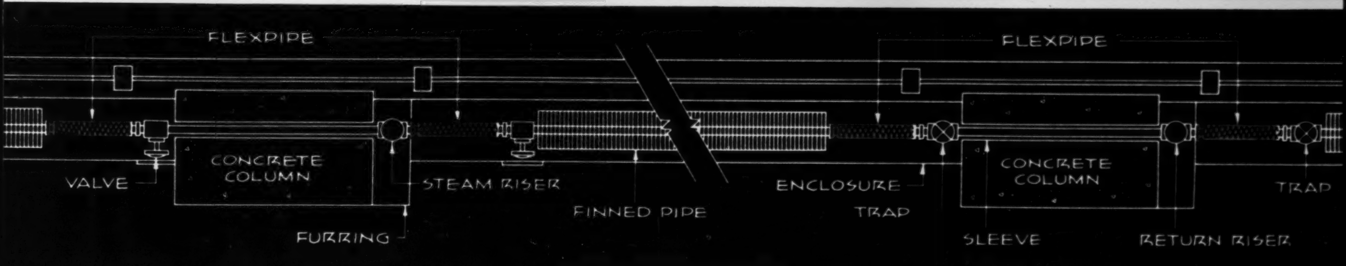
THE GREEN FUEL ECONOMIZER CO., INC.,
BEACON 3, NEW YORK

APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe®



PLAN VIEW A (ENLARGED)



PLAN VIEW B

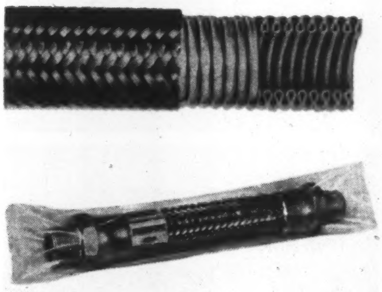
Fulton-Hempstead Building, Hempstead, N. Y. Professional Engineer: Saul Goldsmith. Air Conditioning Contractor: J. W. Hubert Corp., New York, N. Y.

Flexpipe connectors in office building heating system reduced number of risers and furring at columns

THE PROBLEM: Structural concrete columns posed a few problems in installing finned-pipe steam radiation beneath the continuous windows in the modern 10-story Fulton-Hempstead Bldg., Hempstead, L. I. With steam and return risers located alongside the columns, there wasn't room for the usual pipe and fittings to take care of vertical and lateral expansion. The conventional practice of making these connections from the floor below in a hung ceiling was rejected as too expensive.

THE SOLUTION: The use of Flexpipe flexible connectors to take care of expansion was a natural. This approach also made it possible to reduce the number of risers by half—by connecting finned pipe in two bays to one riser. Ordinarily this would have meant piping around columns, with expensive enclosure or furring out (see Plan View A). Instead, the piping was run through the columns and connections to finned tubing made with Flexpipe (see Plan View B). This was easily done by attaching sleeves through the columns to the forms before the concrete was poured. With only one riser per column, only one side of each column had to be furred out.

WHERE TO BUY. Flexpipe connectors come in convenient standard sizes from ¼ inch through 2 inch, and are sold by leading distributors. They can show you samples and answer questions about service applications. For the name and address of the one serving your area, or for more detailed information, write to: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 58224 Rev.



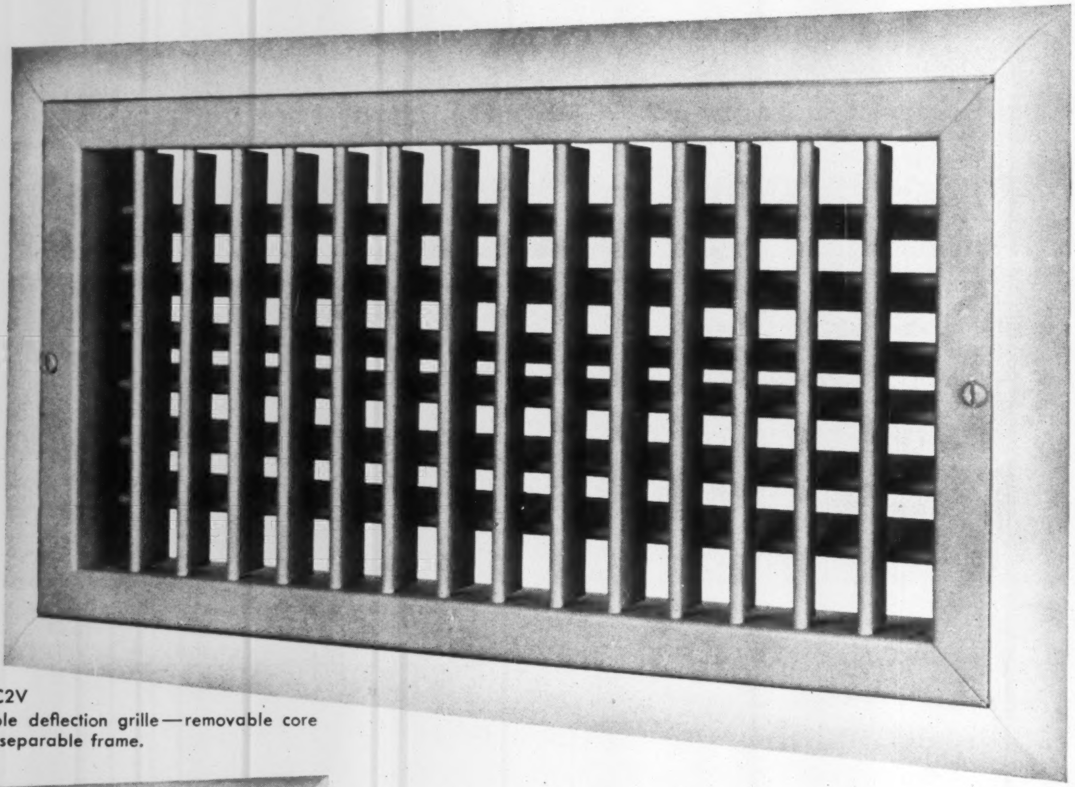
FLEXPIPE has core of seamless tin bronze tubing corrugated for flexibility. No packing. 100% tight. Tin bronze wire braid covering for extra strength. Brass fittings attached. Packaged in clear, tough polyethylene bag for easy identification, handling and warehousing.

Flexpipe® an ANACONDA® product

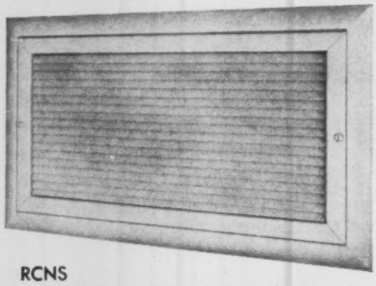
made by The American Metal Hose Division

of The American Brass Company

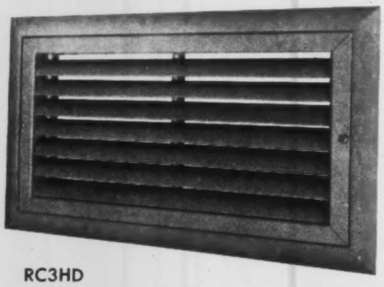
Now... WATERLOO *presents*
removable core grilles



RC2V
Double deflection grille—removable core with separable frame.



RCNS
"No-Site" inverted V shaped blades with removable core and separable frame.



RC3HD
Return air grille with fins fixed at 45° with removable core and separable frame.

Completely removable cores–unique design separable frames

Designed to enhance all modern interiors, these new Waterloo removable core grilles offer many significant advantages:

1. Cores slip out easily—prevent damage to plaster or painted walls.

2. Unique design separable frames allow maximum free area. Trim radius edges of frames add streamline appearance to room decors.

3. Removable core grilles are either all aluminum construction or separable aluminum frames with conventional cores. Either type may be specified.

4. Waterloo removable cores are available with models shown or on any other Waterloo supply and return grilles or registers.

Reap these benefits by specifying Waterloo removable core grilles on your next job. *Write for new comprehensive Waterloo Catalog.*

WR-110

WATERLOO
Air Diffusion
EQUIPMENT

WATERLOO REGISTER COMPANY, INC.
WATERLOO, IOWA

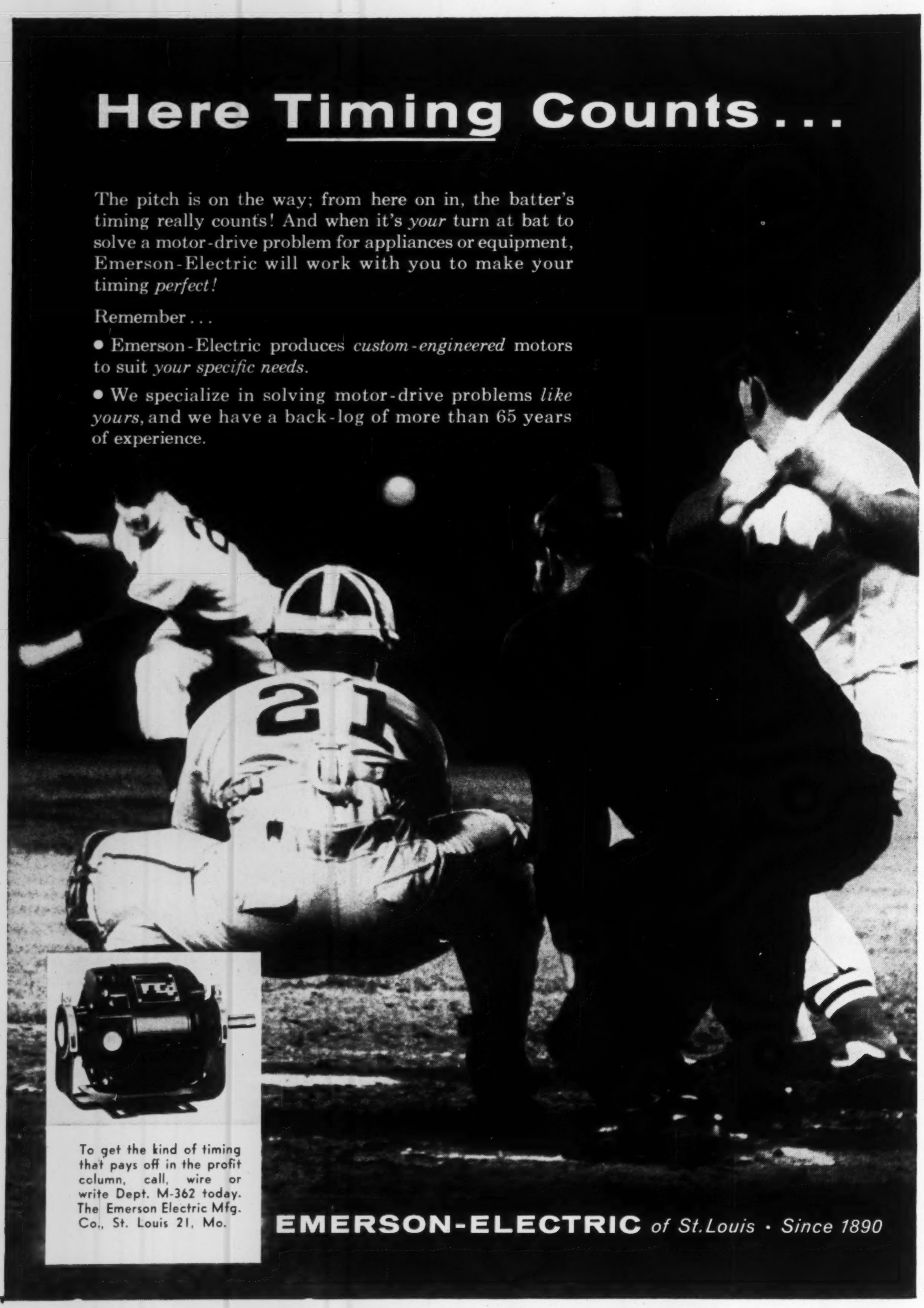
They compared "K" factors and cost factors ... and bought SNAP*ON®

Here's how you can reduce the cost of insulating large pipe— simply use Snap*On, the original one-piece pipe insulation molded of fine glass fibers. You can use Snap*On in thinner wall thicknesses — *and obtain the same, or superior insulating efficiency* — for Snap*On's thermal efficiency is unique among general-purpose pipe insulations. Application couldn't be easier or more economical — particularly when you use big 6′ one-piece sections that snap on big pipe quicker than you can say "Snap*On!"

Compare these and many other Snap*On advantages by asking your G-B distributor to make a TEVA (Thermo-Economic Value Analysis) survey the next time you plan to insulate piping, be it hot or cold, large or small, indoors or out. Snap*On is available in the *complete* range of sizes from copper tubing to 36″ IPS . . . plain, or with a variety of weatherproof and vapor barrier jackets.

FOR FREE TEVA SURVEY CALL YOUR LOCAL
G-B SNAP*ON DISTRIBUTOR
(LISTED IN YELLOW PAGES)

GUSTIN-BACON Manufacturing Co gb GUSTIN BACON
220 W. 10th St., Kansas City, Mo.
Thermal and acoustical glass fiber insulations . . . molded glass fiber pipe insulation
Couplings and fittings for plain and grooved end pipe



Here Timing Counts . . .

The pitch is on the way; from here on in, the batter's timing really counts! And when it's *your* turn at bat to solve a motor-drive problem for appliances or equipment, Emerson-Electric will work with you to make your timing *perfect!*

Remember . . .

- Emerson-Electric produces *custom-engineered* motors to suit *your specific needs.*
- We specialize in solving motor-drive problems *like yours,* and we have a back-log of more than 65 years of experience.

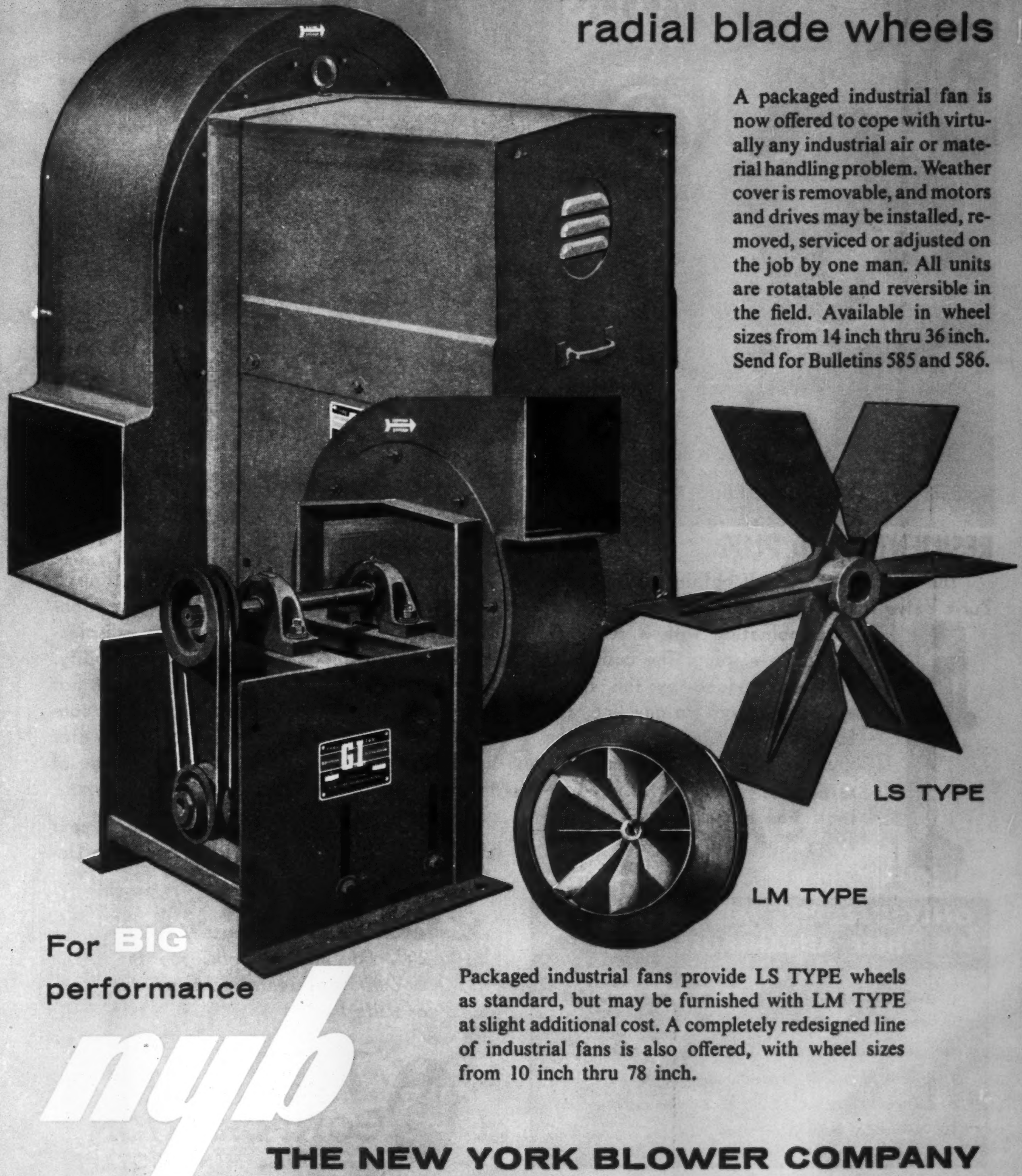
To get the kind of timing that pays off in the profit column, call, wire or write Dept. M-362 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.

EMERSON-ELECTRIC *of St. Louis · Since 1890*

...economical G. I. type

PACKAGED INDUSTRIAL FANS

...featuring flat radial blade wheels



A packaged industrial fan is now offered to cope with virtually any industrial air or material handling problem. Weather cover is removable, and motors and drives may be installed, removed, serviced or adjusted on the job by one man. All units are rotatable and reversible in the field. Available in wheel sizes from 14 inch thru 36 inch. Send for Bulletins 585 and 586.

Packaged industrial fans provide LS TYPE wheels as standard, but may be furnished with LM TYPE at slight additional cost. A completely redesigned line of industrial fans is also offered, with wheel sizes from 10 inch thru 78 inch.

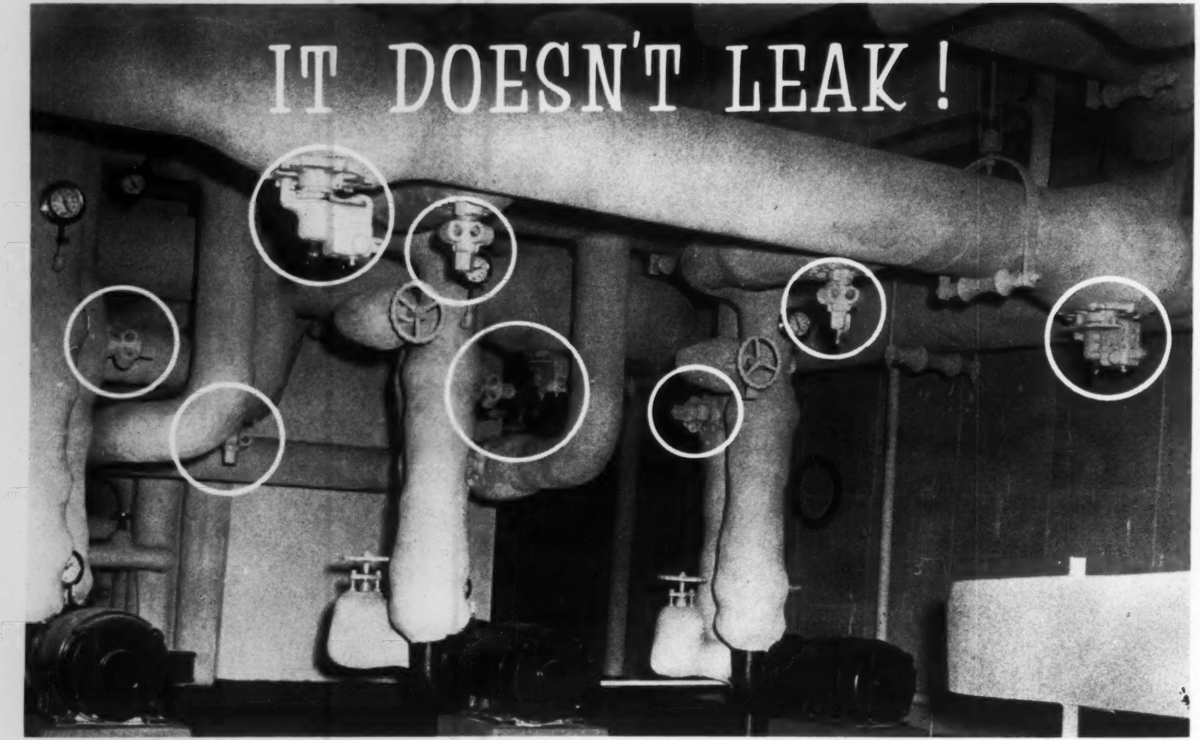
For BIG performance

nyb

THE NEW YORK BLOWER COMPANY

Sales Offices: 3149 South Shields Avenue • Chicago 16

DeZURIK..*the BEST valve for air conditioning because...*



RESILIENT FACED PLUG

The dead-tight shut-off obtained with a DeZurik Valve is the result of its Eccentric Action in combination with a resilient-faced metal plug. The cushioned closure provided by this resiliency seals tight on *any* line. The Eccentric Action matches the plug face to the eccentrically-raised body seat for positive contact. You get drip-tight shut-off every time.

DEAD-TIGHT SHUT-OFF

The installation pictured is in the Baltimore County Court House (Egli and Gomph, Consultants). The DeZurik Valves are used as isolating valves, installed inverted for accessibility. Because the same pumps are used on both hot water for heating and chilled water for air conditioning, these valves, on the chilled water lines, have to shut tight to prevent leakage of the hot water to the chillers.

Get this same dead-tight shut-off on your air conditioning installations by specifying DeZurik Valves!

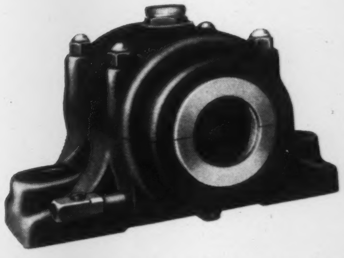
ONLY DeZURIK VALVES GIVE YOU ALL THESE ADVANTAGES:

1. Easy Operation
2. Drip Tight Shut-off
3. Low Pressure Drop
4. Best for Balancing
5. Low Installation Cost
6. No Maintenance
7. Proved Record of Dependability
8. Compact Size
9. Economically Priced
10. Versatility beyond compare

Available in sizes from 1/2" thru 20". For more details, see the DeZurik representative near you, or write to

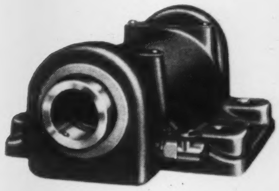
DeZURIK CORPORATION
SARTELL, MINNESOTA

QUIET



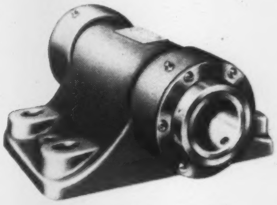
DODGE SLEEVOIL PILLOW BLOCKS

Exceptionally quiet in operation. Noted for superb quality. Plain and Water Cooled Types. Precision-built, ring-oiling, babbitted. Self-aligning. Can be drilled for thermostatic emergency warning. Shaft sizes from 1-7/16″ to 10″.



DODGE BRONZE BUSHED PILLOW BLOCKS

Designed for Arrangement No. 2 installations. Two bronze bushings of high lead content mounted in one cast iron housing. Special T-section rings for dependable lubrication. Exceptionally quiet in operation. Shaft sizes from 15/16″ to 2-3/16″.



DODGE BALL BEARING PILLOW BLOCKS

Designed for Arrangement No. 2 installations. Two precision single row, deep groove ball bearings in one cast iron housing. Extended inner race carries shaft. Remarkable ease of installation and maintenance. Shaft sizes from 15/16″ to 2-3/16″.

These quality bearings have been developed in close cooperation with manufacturers of fan and blower equipment — to meet the highly specialized requirements of this field.

The nation's great generating plants choose these bearings because of their extraordinary dependability—and they are widely used in air conditioning systems that call for continuous operation both in public and industrial service.

Dodge Fan and Blower Bearings are available from stock—with stock-product economy. Consult your local Dodge Distributor—or write us for technical data.

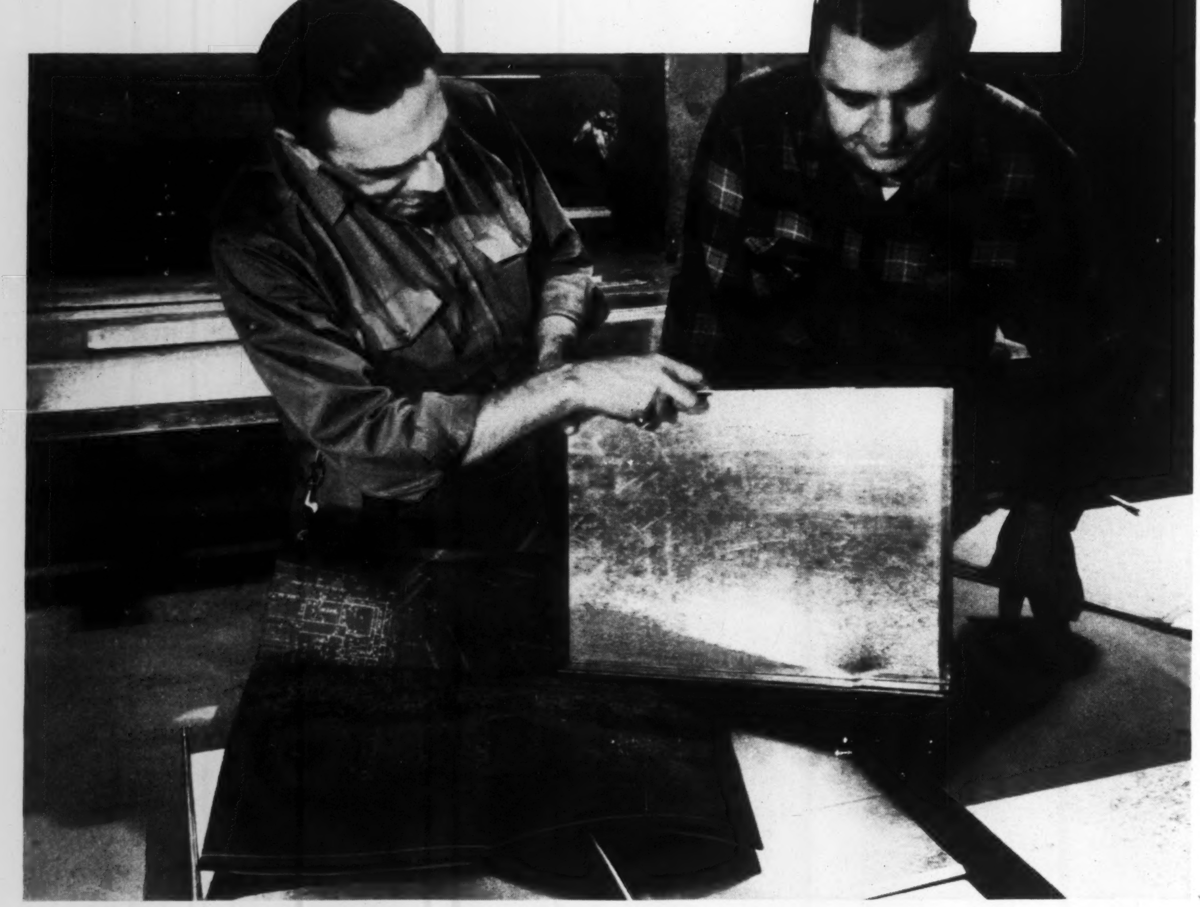
DODGE MANUFACTURING CORPORATION
1600 Union Street, Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

MANUFACTURER OF AMERICA'S MOST COMPLETE LINE OF MOUNTED BEARINGS

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."

Put a Bethcon sheet through the toughest operation in your shop



You can make snap locks, Pittsburgh lock seams or some special seam of your own without damaging either the zinc coating or the steel base of a Bethcon sheet. That's because Bethcon sheets are galvanized by a continuous process which bonds the zinc to the base metal much more tightly than conventional methods.

SPECIAL ANNEALING IMPROVES DUCTILITY

Another advantage of the Bethcon continuous galvanizing process is the remarkable combination of ductility and strength in the sheet, which stems from the special annealing cycle in the continuous line. You'll find a Bethcon sheet neither too soft nor too stiff, but just right for easy workability and a sturdy end-product. The zinc is distributed evenly over the sheet, so that the finished sheet is uniform in thickness and appearance. And there is no drip end.

You can specify Bethcon in a wide variety of gages, in plain steel or copper-bearing (Beth-Cu-Loy) for extra corrosion-resistance. If you have not yet worked with Bethcon, you might like to talk with someone who has. Or perhaps you'd prefer to discuss it with one of our own men. Either way, you'll get prompt attention by getting in touch with our nearest district sales office.

You really ought to try Bethcon. Why not call us now?

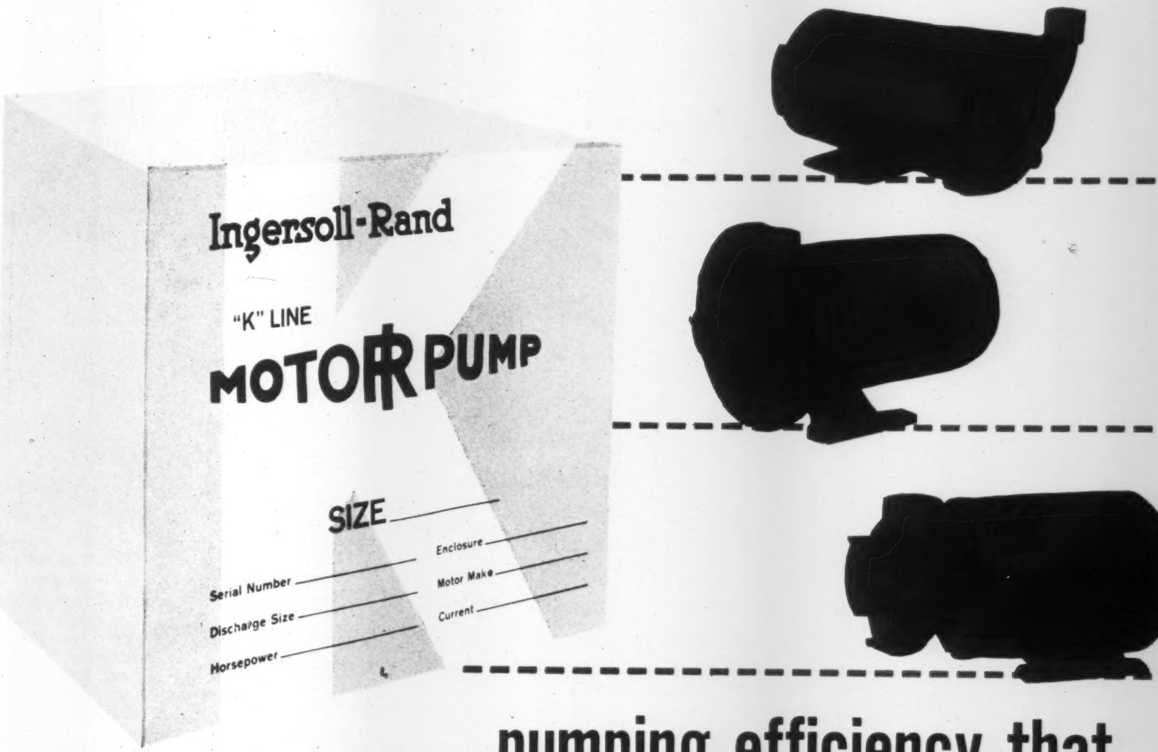
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

New I-R "K" Line Motorpump...



pumping efficiency that matches all air conditioning systems

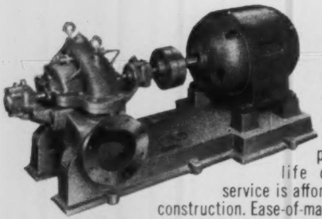
Now—with Ingersoll-Rand's new "K" Line Motorpumps—you have a complete range of efficient pumping power to meet the requirements of any air conditioning system! "K" Line Motorpumps add low cost dependability backed by the recognized leader in centrifugal pumps—Ingersoll-Rand.

These packaged Motorpumps come in 20 sizes to cover a range up to 775 gallons per minute and heads up to 190 feet. They are easily stocked and easily selected for a given job. Moreover, their rugged construction and modern features combine to deliver continuous, trouble-free service—saving you time and trouble in costly call backs.

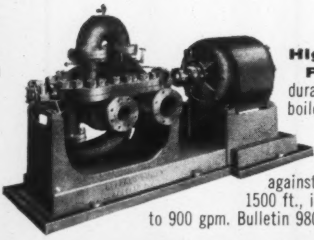
See for yourself how the new I-R "K" Line Motorpumps can increase your sales and profits. Write today for complete information to: Sales Manager, Merchandising Division, Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y.

Ingersoll-Rand
Merchandising Division
11 Broadway, New York 4, N. Y.

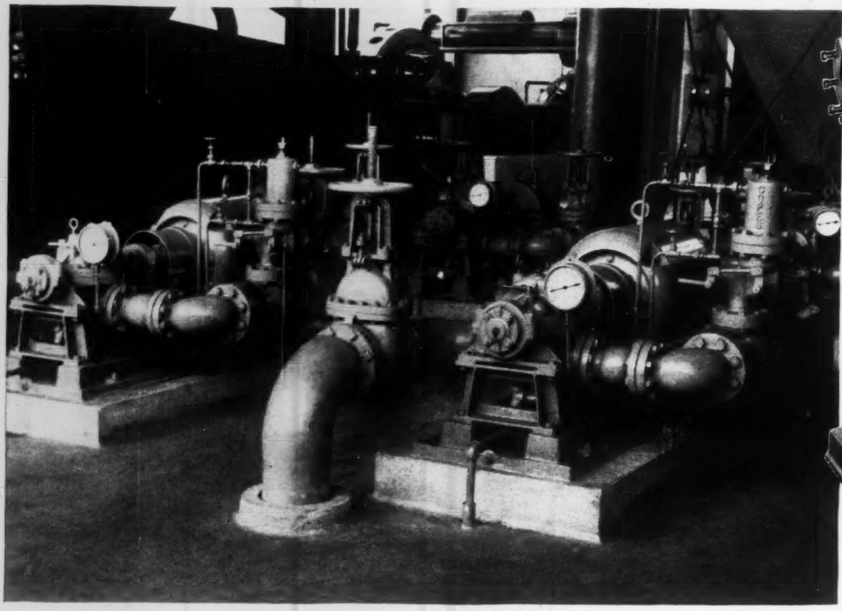
9-871A

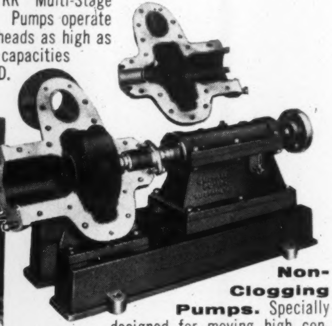


Clear Water Pumps. "Buffalo" Type "SL" Double Suction Pumps are designed for peak efficiency in clear water applications. A long life of economical service is afforded by their rugged construction. Ease-of-maintenance is a built-in feature. 10 to 14,000 gpm capacities. Bulletin 955-R.

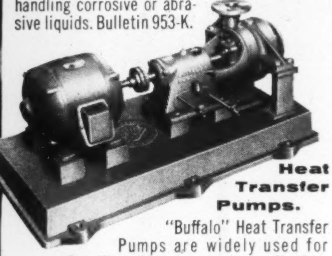


High Pressure Pumps. Offering efficiency, durability and dependability for boiler feed water and other clear water service, "Buffalo" Type "RR" Multi-Stage Pumps operate against heads as high as 1500 ft., in capacities to 900 gpm. Bulletin 980-D.

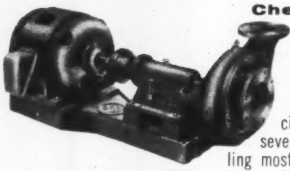




Non-Clogging Pumps. Specially designed for moving high consistency liquids, "Buffalo" Diagonally Split-Shell Pumps reduce down time, wear and "wedging". Rubber-lined models available for handling corrosive or abrasive liquids. Bulletin 953-K.



Heat Transfer Pumps. "Buffalo" Heat Transfer Pumps are widely used for handling high-temperature liquids. Ruggedly-built with special alloys, they utilize water-cooled bearings and packing. Efficient, single-suction, solid shell design. Write for application information.



Chemical Liquid Pumps. Choose from 10 special types of "Buffalo" Pumps in a variety of trim. Specially engineered for severe service in handling most corrosive, abrasive or high consistency liquids. Bulletin 982-A.

PUMPING EFFICIENCY TAILORED TO YOUR NEEDS

What are your liquid moving needs? Chances are, you'll find the right pump for your job from the complete "Buffalo" line.

You can rely on "Buffalo" Pumps to perform with maximum efficiency and dependability. Their rugged construction insures a long life of maintenance-free operation. Economy, too, is a big factor. For example, interchangeability of parts is designed into "Buffalo" Pumps through standardization. This saves you valuable dollars in lower parts inventories.

Add to these advantages the helpful services of the "Buffalo" engineering team, and you have every reason to choose "Buffalo" Pumps for your particular needs. This engineering know-how is backed by more than 80 years of broad experience in solving liquid moving problems.

Whatever your pumping needs, call in your nearby "Buffalo" representative. He'll be glad to help you select the pump best-suited to your job. Or write us direct for full information and bulletins.

"Buffalo" Pumps bring you the "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life.

"Buffalo" PUMPS

BUFFALO PUMPS
Division of Buffalo Forge Co.
171 MORTIMER ST. • BUFFALO, N. Y.

Canada Pumps, Ltd., Kitchener, Ont. • Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

"SPECIAL" Welding Fittings

by MIDWEST

"SPECIAL" DESIGNS

"SPECIAL" MATERIALS

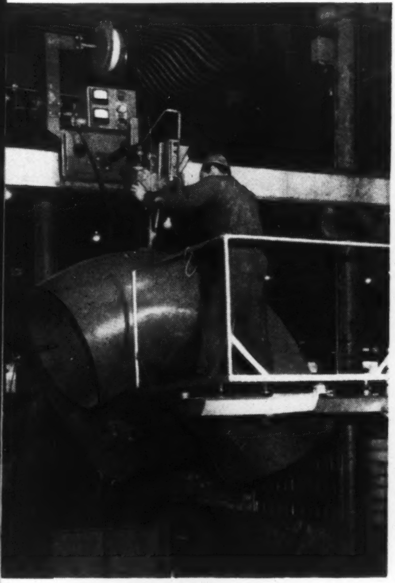
"SPECIAL" QUALITY

"SPECIAL" DELIVERY

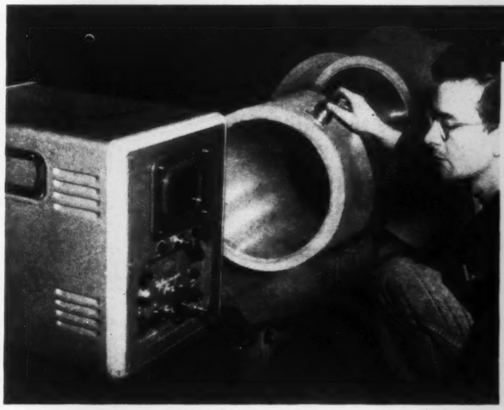
Special gauges and instruments are used to make sure that we have complied with the extremely close tolerances often required on stainless fittings. Here wall thickness and concentricity were held within extremely close limits throughout the fittings.

The exclusive Midwest method of manufacture—much more versatile and flexible than any other—enables us to make almost any type of special welding fittings to the most rigid specifications. Midwest makes welding fittings from *plate* . . . usually much easier to get than pipe, particularly if the material is special. That expedites delivery. Closer tolerances are inherent in the Midwest process, and quality control is always beyond code requirements.

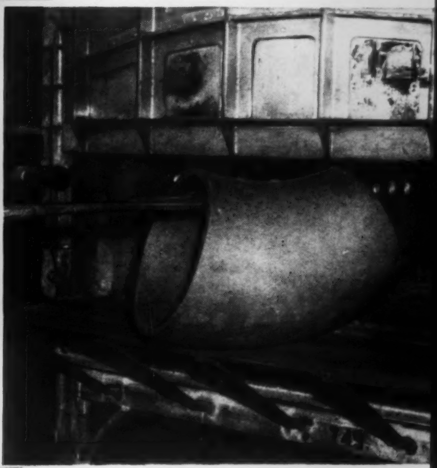
Even if you use only standard fittings, the exceptional quality of Midwest fittings can be important to you. Ask your Midwest distributor or write us for new Bulletin 5801.



36" O.D. 90° elbow with 16" tangent on one end being welded by an automatic submerged arc machine. Material is A-201 carbon steel.



Stainless-clad elbows undergoing ultrasonic inspection to check bonding of material and quality of weld. Since plate is often the only form in which clad material is available, the Midwest process is able to produce the most comprehensive range of clad fittings—and to do so promptly.



Special 24" x 21" 45° reducing elbow made of 1" thick 1¼% chrome ½% moly steel ready for heat treating furnace.

MIDWEST PIPING COMPANY, INC.

Main Office: St. Louis 3, Mo. (P. O. Box 433)
PLANTS: ST. LOUIS, CLIFTON, N. J. and LOS ANGELES

SALES OFFICES:
Asheville—(Box 446, Skyland, N.C.) • Atlanta 9—72 11th St., N.E.
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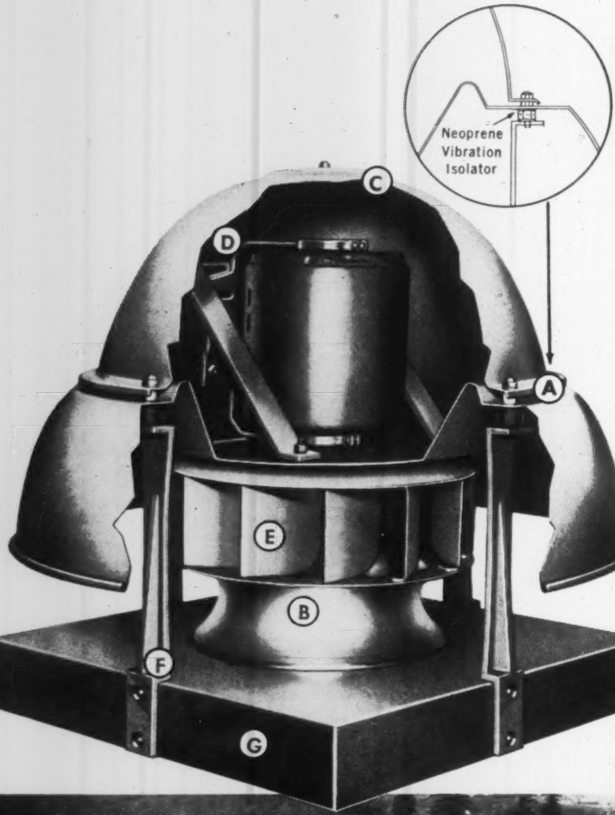
St. Louis 4—1450 South Second St.
Tulsa—1640 E. 21st St.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

Feature by Feature...
COMPARE
Exit-Aire



the complete line of power roof ventilators

ExitAire exhausters are designed and built to provide the finest ventilation available at modest cost. Compare the unprecedented performance features of the ExitAire with those of other ventilators!

A. NEOPRENE VIBRATION ISOLATORS for silent operation (see illustration at left). Motor compartment is supported by 4 rugged cast aluminum brackets, insulated from vibration to curb by individual Neoprene "sandwich" dampeners. Motor is resiliently mounted. No need for rubber curb mountings.

B. NEW "AIRE-FLOW" INLET CONE similar to centrifugal blower-type for maximum efficiency with air turbulence reduced to a minimum. Allows use of smaller wheel which is quieter in operation and easier to keep in balance.

C. LOW SILHOUETTE conforms with modern architecture!

D. DISCONNECT SWITCH provided for mounting in motor compartment. Standard on single speed unit 10" and larger.

E. NEW WHEEL DESIGN delivers more capacity, horsepower for horsepower, than conventional wheels! Small size enhances balance.

F. CURB-MOUNTED BRACKETS! For extra rigidity, unit is suspended by 4 cast-aluminum brackets attached directly to the curb.

G. COMPLETE CURB MOUNTING! An integral part of unit, no extra cost!

ExitAire Specified for Engineering Building, Cal-Poly College, Pomona, California.

This installation of 15", 18" and 24" ExitAire Power Roof Ventilators is typical of many jobs all over the country where ExitAires have been chosen because of their higher efficiency per ventilating dollar.

EXITAIRE GIVES YOU CERTIFIED PERFORMANCE RATINGS, TOO!

ExitAire Power Exhausters carry the Certified Rating Seal of the Air Moving and Conditioning Association... Underwriters' Laboratories, Inc. listing on most power units. You can be *sure* when you specify ExitAire!

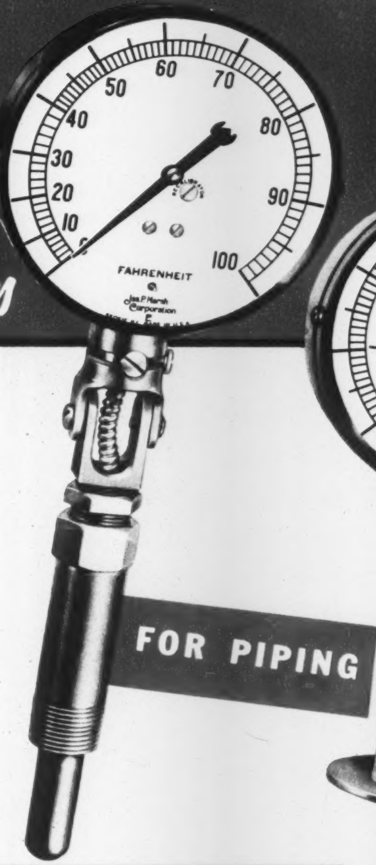
Compare—you'll buy *ExitAire!*

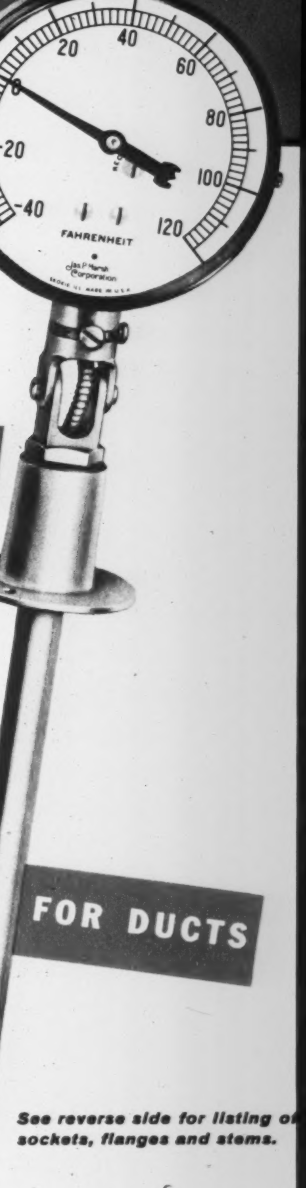
Write for Bulletin 458. A.I.A. File No. 12K2 with complete specifications and engineering data.

***Exit-Aire* COMPANY**
P.O. Box 276, Pacoima, California

NEW!

MARSH Dial Thermometers



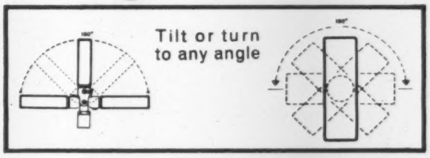


Designed expressly for piping and duct work

One careful look at this new line of Marsh instruments will convince you that we have put into them *everything* that has been so long and widely needed in dial thermometers for piping and duct work . . . thermometers for use on heating and cooling equipment—for piping, air ducts, vessels and kilns, ovens and similar installations.

THE LINE IS COMPLETE. Four types, 7 ranges . . . 72 combinations to meet almost every conceivable condition as listed on the reverse side of this page. All have basic features that are found only in the Marsh line:

FAR MORE READABLE. Big, legible 3½" and 4½" dials . . . easy to see in places where piping and duct thermometers must be located. An even greater contribution to ease of reading is the provision for tilting and turning dials to any required angle of vision as diagrammed here and on the following page. No more climbing ladders or using flashlights to read obscure glass tube thermometers. And note that the line includes distant reading types that bring the dial into view even if the point of measurement is completely out of range.



UNBREAKABLE. Instead of the fragile glass tube thermometers customarily used for piping and duct work you now have the sturdy, unbreakable Marsh Dial Thermometer . . . long recognized as the best; now still more highly perfected.

MORE ACCURATE. Guaranteed accurate to plus or minus one division of the big open scale, these instruments have far greater *readable* accuracy than any glass tube thermometer. They also have the famous Marsh "Recalibrator"—to *keep* them accurate.

MORE ADAPTABLE. Your needs "designed" these instruments! Notice in the specifications on the following page how their design provides for every field condition. Separable sockets ("wells"), along with swivel nut for attachment of thermometer to socket, makes them easy to install—or to disconnect for servicing. Extension necks take care of insulated piping or ducts. Long stems in duct types place temperature-sensitive section where it should be for accurate indication.

To know the full scope of this new Marsh line read the specifications on the reverse side of this page. Every instrument in the line is—

Available from stock

Write for Bulletin PD

For piping

Dial Sizes: 3½" and 4½".

Ranges: 0° to 100° F for chilled water.
20° to 120° F for condenser water.
40° to 240° F and 100° to 300° F for hot water and domestic water.

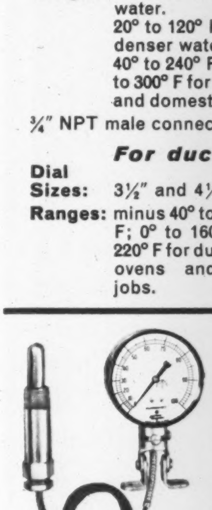
¾" NPT male connection.

For ducts

Dial Sizes: 3½" and 4½".

Ranges: minus 40° to plus 120° F; 0° to 160° F; 0°—220° F for ducts, kilns, ovens and similar jobs.

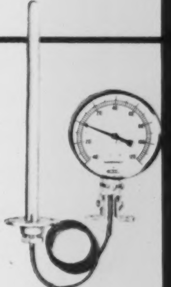
See reverse side for listing o
sockets, flanges and stems.



Also remote reading

Piping and duct thermometers of same basic design are available with six feet of capillary tubing as shown.

See reverse side for listing of sockets, stems, ranges, etc.



. . . . Specifications on reverse side

specifications OF MARSH PIPING AND DUCT THERMOMETERS

(read complete description on preceding page)

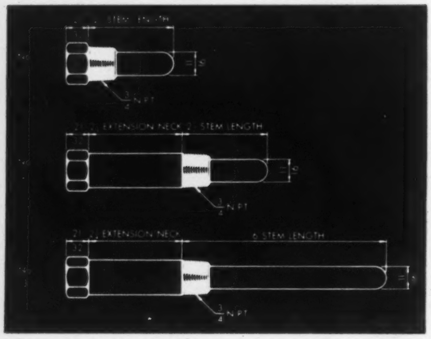
PIPING THERMOMETERS

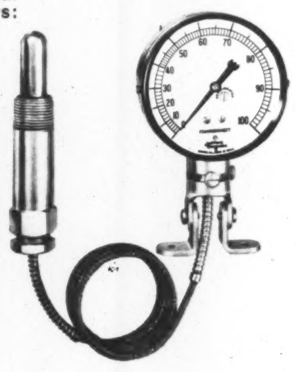
Piping thermometers are the Vapor Tension type which permits wide divisions in the important reading area (see cuts). They are standard with Marsh "Recalibrator." Both direct mounting and remote reading types, as illustrated here, are standard as follows:

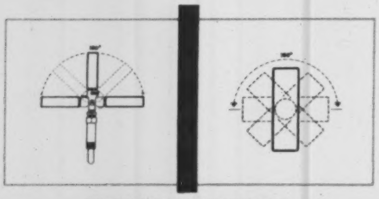
Two sizes:
3½" and 4½" dial size.

Four ranges:
0° to 100° F for chilled water.
20° to 120° F for condenser water.
40° to 240° F for hot water heating and domestic hot water.
100° to 300° F for hot water heating and domestic hot water.

Connection
¾" NPT male.

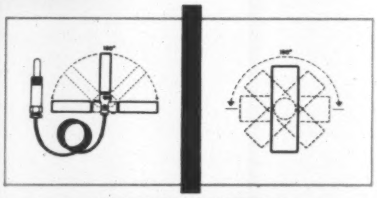






DIRECT MOUNTING

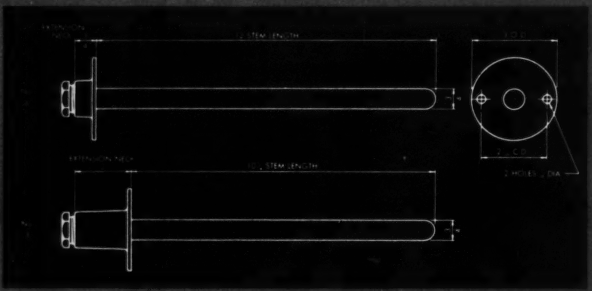
Three standard separable sockets for any thermometer in any range (see dimensions in drawing). Additional sockets may be purchased. Diagrams show how thermometers may be tilted and rotated.

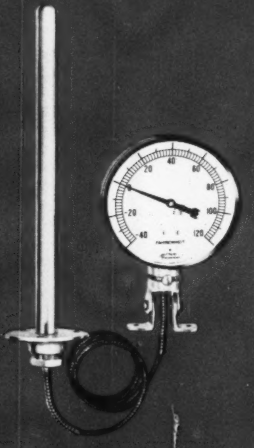


REMOTE READING

DUCT THERMOMETERS

Duct thermometers are the Gas Filled type, ideal for the wide ranges required. They are standard with Marsh "Recalibrator." Both direct mounting and remote reading types, as illustrated here, are standard as follows:

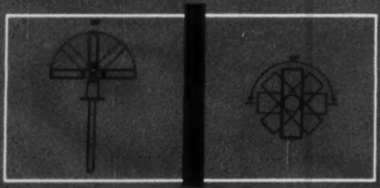




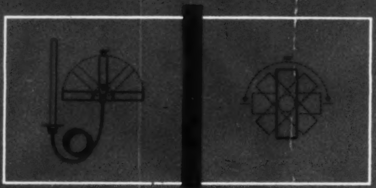
Two sizes:
3½" and 4½" dial size.

Three ranges:
minus 40° to plus 120° F
0° to 160° F
0° to 220° F

Two extension necks and stem lengths for any thermometer in any range (see dimensions in drawing). Diagrams show how thermometers may be tilted and rotated.



DIRECT MOUNTING



REMOTE READING

MARSH

Marsh products include: Pressure Gauges • Dial Thermometers • Steam Traps, Radiator Valves and Traps, Vents and other heating specialties • Refrigeration Testing Instruments • Water Regulators • Solenoid Valves • Needle Throttling Valves.

Write for bulletins **Jas. P. Marsh Corporation, Skokie, Ill.**

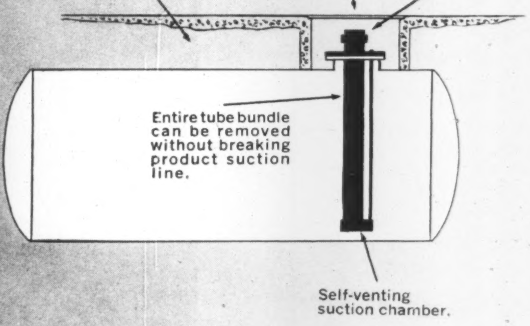
NOW... for underground fuel oil storage tanks—
a tank suction heater with easily accessible service connections

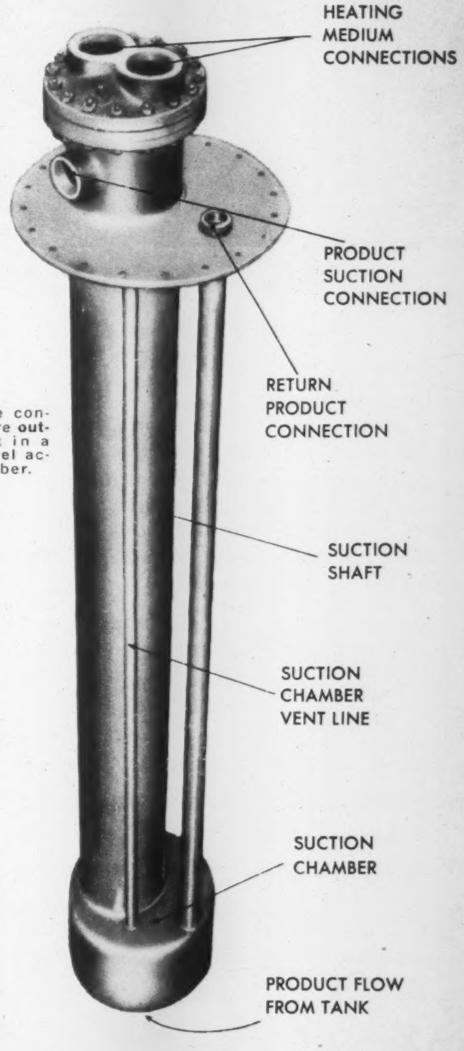
PARACOIL "VUF"
VERTICAL TANK SUCTION HEATER

Designed to simplify both installation and service. Heater is suspended from tank manhole flange. **All connections are outside the tank.**

Uses hot circulated fluids as heating mediums — insuring positive suction temperatures.

The simplest method of preheating fuel oils and other viscous liquids in underground storage tanks.


Only normal depth from ground level required.
Top end chamber can be removed to expose tube ends for inspection.
All service connections are outside tank in a ground-level access chamber.
Entire tube bundle can be removed without breaking product suction line.
Self-venting suction chamber.


HEATING MEDIUM CONNECTIONS
PRODUCT SUCTION CONNECTION
RETURN PRODUCT CONNECTION
SUCTION SHAFT
SUCTION CHAMBER VENT LINE
SUCTION CHAMBER
PRODUCT FLOW FROM TANK

Hot return product mixes with fresh product in suction chamber, providing an initial temperature rise even before the heating tubes are reached.

Available in standard sizes and capacities for various product fluids.

Alternate Model (Type VSS) employs high pressure steam as the heating medium.

Write for Bulletin 60-J1

DAVIS ENGINEERING CORPORATION

30 Rockefeller Plaza, New York 20, New York • Circle 6-5650

TODAY...
almost everyone plays it SAFE with
SPORLAN *Catch-Alls*

. . . the Perfect Filter-Drier

because

they know the INSIDE STORY

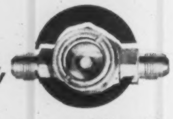
The famous Sporlan molded porous Catch-All core is a blend of highly efficient desiccants that now offers EVEN GREATER drying capacity. It is activated after assembly to the highest degree of dryness, then immediately sealed against any loss of activation before installation with moisture and tamper-proof seals.

The Catch-All dries the refrigerant down to such an extremely low end point that any remaining moisture is absolutely harmless!

It cannot powder or pack . . . the refrigerant cannot by-pass or channel around it. As a matter of fact, the famous Sporlan molded porous core Catch-All offers the only true filtering device capable of filtering out foreign matter with negligible pressure drop. Harmful corrosive acids are adsorbed and retained within the core itself.

You, too can play it safe *and get perfectly clean, perfectly dry refrigeration systems . . . buy Sporlan Catch-Alls, the perfect filter-driers with the famous molded porous cores that now give even greater drying capacity.*

Buy Sporlan *See•Alls*, too . . .



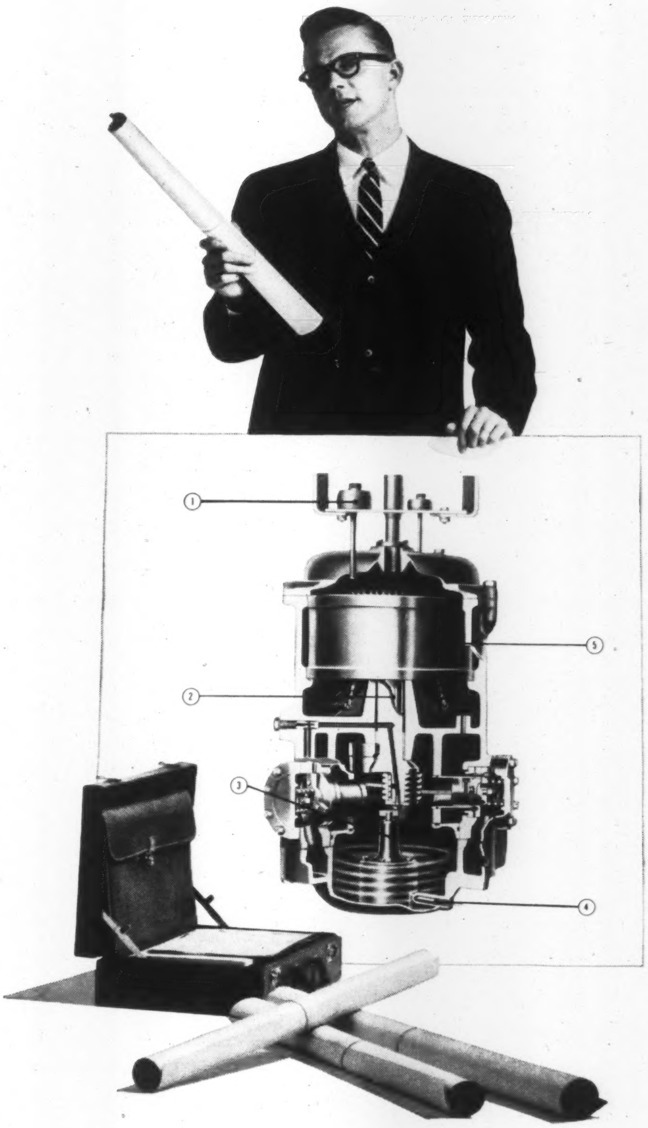
the amazing new moisture and liquid indicator that takes the guess-work and worry out of every installation.

See your Sporlan Wholesaler today!

SPORLAN VALVE COMPANY

7525 SUSSEX AVE. ST. LOUIS 17, MO.
EXPORT DEPT. 85 BROAD STREET, NEW YORK 4, N. Y.

Our 25th Anniversary . . . 1934-1959



Here are 5 of the 18 reasons why it pays to pick Chrysler Liquid Chillers

Cooling for comfort? Or cooling a process? Only Chrysler Airtemp SW Liquid Chillers offer so many exclusive engineering advantages. Take the hermetically-sealed radial compressor, for example. You get:

① *Floating power.* Rubber-in-sheer suspension absorbs vibration. Noise is gone . . . and so are vibration-caused service headaches.

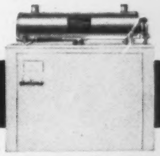
② *Direct drive.* No belts, no pulleys, no seals to break down. You get greater efficiency, less noise from a more compact package.

③ *Positive lubrication.* Exclusive pressure pump is sealed in a bath of oil. Moving parts get constant lubrication for long, trouble-free life.

④ *Crankcase heater.* Prevents refrigerant from condensing and diluting lubricant. Oil stays clean . . . and always ready to flow.

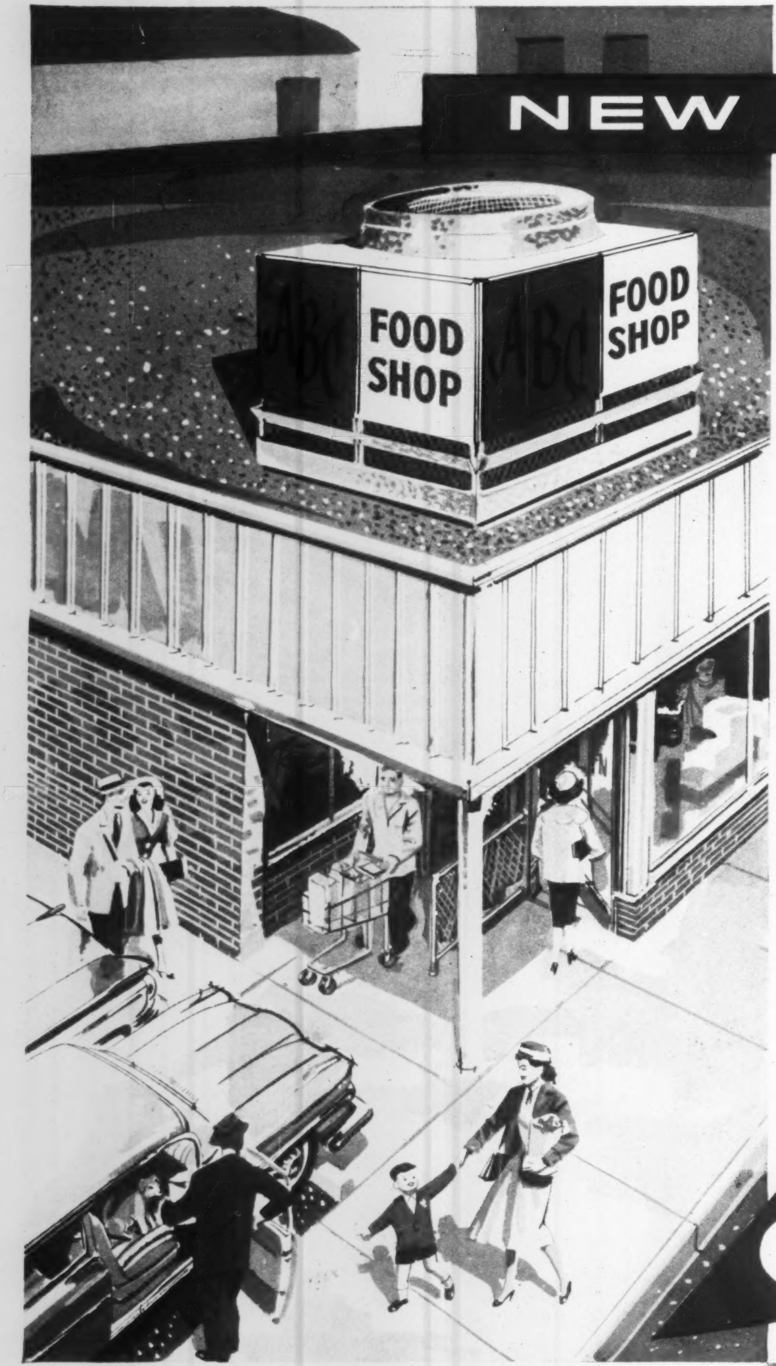
⑤ *Sealed-in motor.* Dust-proof for longer service life. Directly connected to dynamically balanced crankshaft to cut weight and operating costs.

The rest of the 18 reasons? They include innerfin direct expansion chiller, automatic control panel, easier installation and . . . But why not get the complete story from your local Chrysler Applied Machinery and Systems sales office. Or write: Airtemp Division, Chrysler Corporation, Dept. Y-39, Dayton 1, Ohio.



CHRYSLER
AIRTEMP

FIRST WITH THE FINEST IN AIR CONDITIONING



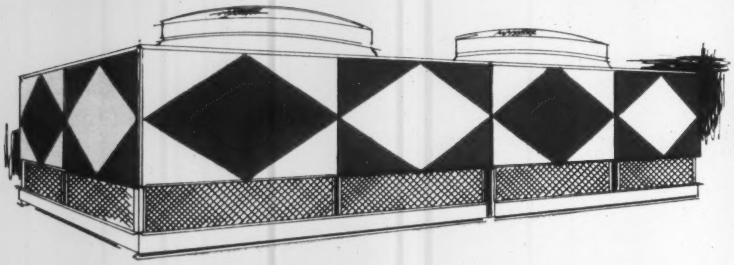
NEW IDEA !

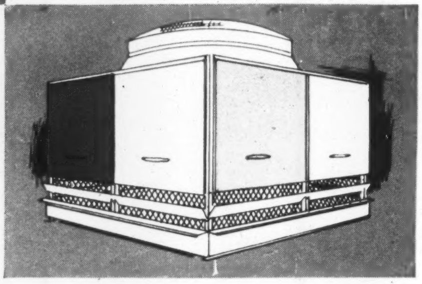
Decorative Cooling Towers . . .

Now, a cooling tower can be an attractive, functional part of a building instead of an object you'd like to hide . . . if it's a Panelramic tower by Pritchard. This new concept in cooling towers features colored panels that lend themselves to a wide variety of architectural treatment. Panels can be used to blend the tower with color scheme of the building, to serve as a distinctive company identification sign, or as a design element in the silhouette of the building. You save your client the cost of masonry enclosures and other expensive devices for camouflaging eyesores.

Panelramic Towers are available in a wide range of capacities and choice of panel materials. Plastic panels, for example, can be furnished with designs or colors permanently bonded in the material. Descriptive bulletin gives additional details and product data. Write for free copy.

J. F. Pritchard & Co.
OF CALIFORNIA
4625 Roanoke Parkway, Dept. 123
Kansas City 12, Missouri





*need slip-on disc 150 lb. valves?

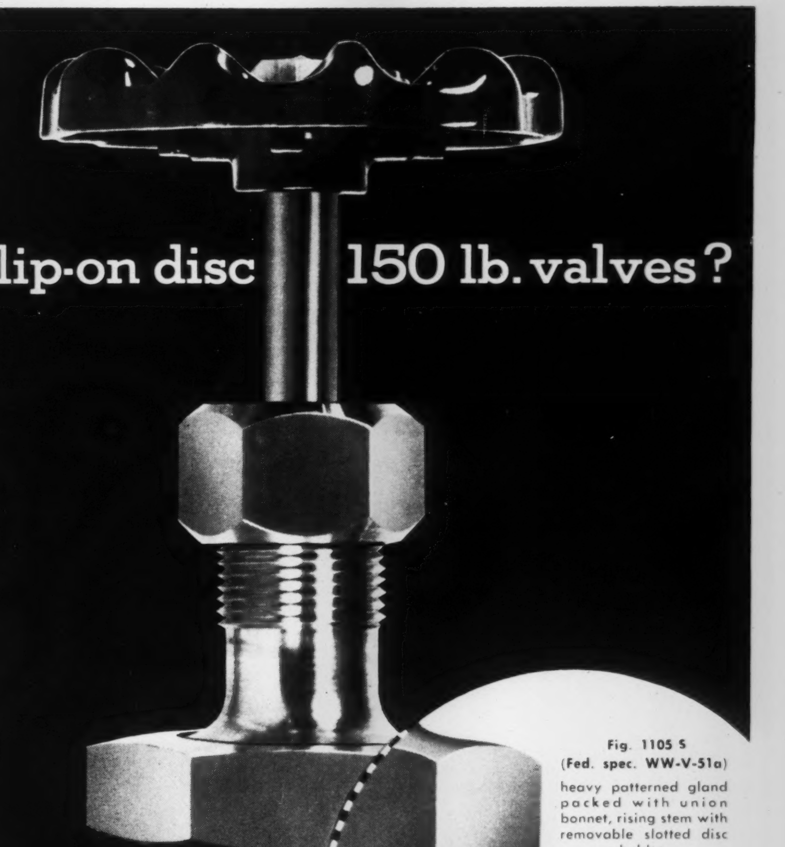


Fig. 1105 S
(Fed. spec. WW-V-51a)
heavy patterned gland packed with union bonnet, rising stem with removable slotted disc holder.

MARSH
MAKES 'EM
AND IN
6 SIZES

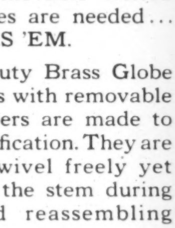
Where quick, easy maintenance is essential and removable *slotted disc holder* valves are needed... MARSH MAKES 'EM.

Our Heavy Duty Brass Globe and Angle Valves with removable slotted disc holders are made to government specification. They are self-centering, swivel freely yet will not slip off the stem during assembling and reassembling operations.

What's more . . . you can have them in ½″, ¾″, 1″, 1¼″, 1½″ and 2″ dimensions. This is only one type of many specially designed valves **MARSH** can supply you for special installations and to meet the most stringent specifications.

For commercial, industrial, domestic or government specification installations the wide range of quality-made, advanced engineered **MARSH VALVES** can keep you in the bidding and in business.

Write us today for a copy of our complete new catalog, and the name of your nearest MARSH VALVE distributor.



Marsh Valve COMPANY
OF DUNKIRK, NEW YORK U. S. A.
Manufacturing Quality Valves Since 1910

NEW IMPROVED

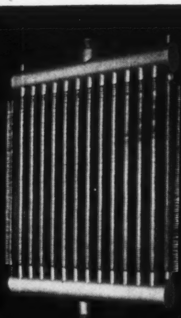
Airtherm

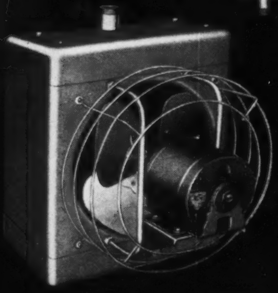
PROPELLER FAN

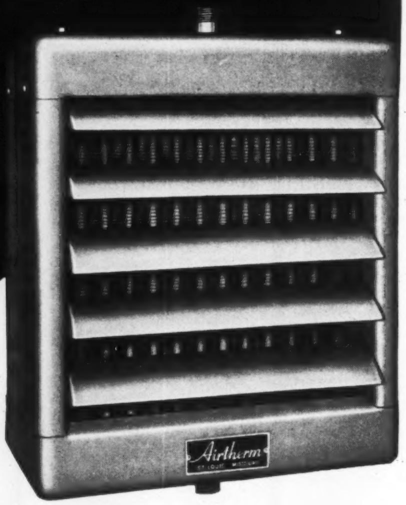
UNIT HEATERS

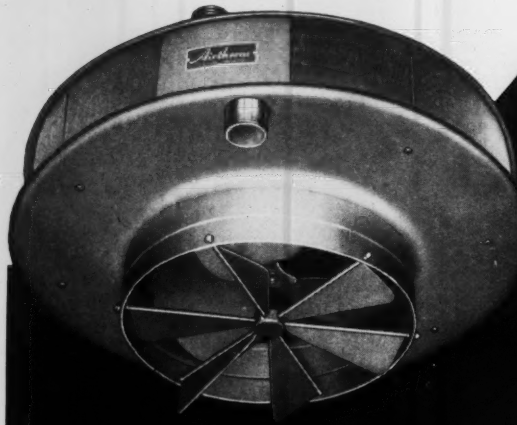
FOR STEAM OR HOT WATER

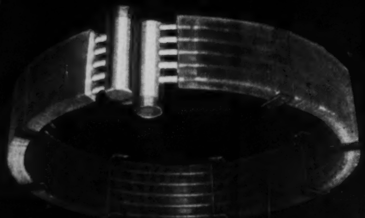
A SIZE FOR EVERY REQUIREMENT









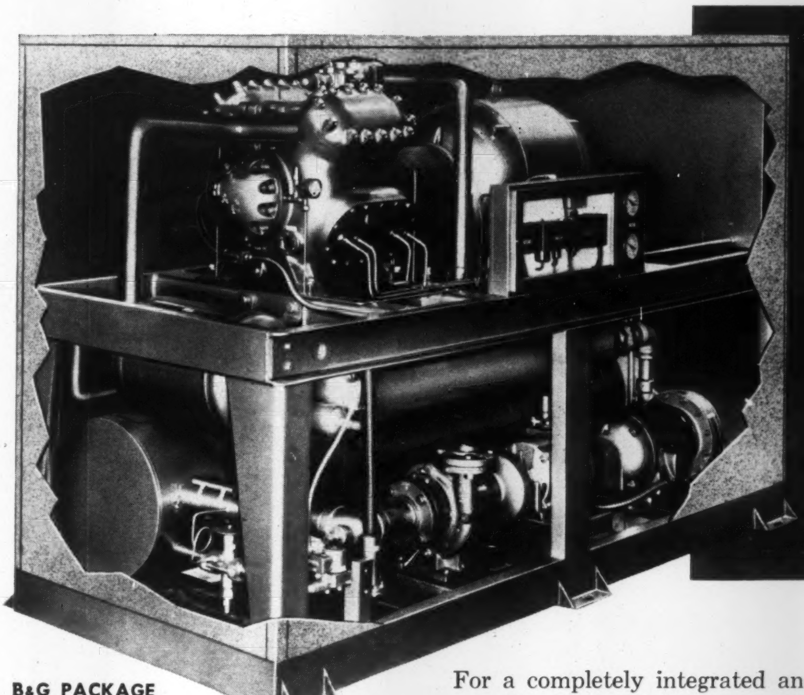


The new Airtherm line incorporates 22 completely redesigned vertical units and 24 improved horizontal units, ranging from 18,000 to 555,000 BTU per hour, with a choice of outlet diffusers to cover practically every air distribution pattern and mounting height. Silent operation is assured by resiliently mounted motors, properly designed fans and casings, and attention to face and outlet velocities. All fans are expertly positioned, balanced and tested. Each unit is tested and rated for performance in strict accordance with the Standard Test Code of the industry. Only brand name, continuous duty motors, especially made for the purpose, are used and mountings are designed for efficient cooling and easy servicing. Rugged coils are formed by hydraulically expanding copper tubing into plate type aluminum fins, each with its own collar, providing increased heat transfer and wide, even spacing to reduce clogging. All coils are tested and tagged for 500 p.s.i. hydrostatic pressure. Casings are phosphatized to insure a long, rust-free life for the attractive baked enamel hammer tone finish.

For Complete Specifications Including a Guide for Selection and Application, Write:

AIRTHERM MANUFACTURING CO.
702 S. SPRING AVE. • ST. LOUIS 10, MO.

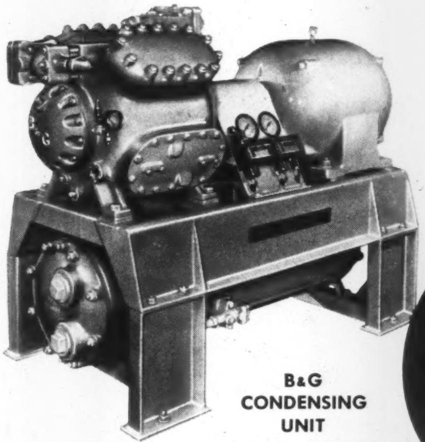
A WELL DESIGNED, COMPACT MACHINE WITH ALL MAJOR COMPONENTS COVERED BY ONE MANUFACTURER'S GUARANTEE!



B&G PACKAGE LIQUID COOLER

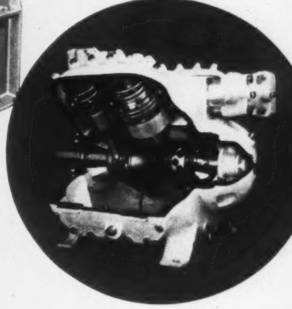
For a completely integrated and assembled water chiller, the B&G Package Liquid Cooler offers many outstanding advantages. It is equipped with B&G products throughout—the only unit of its kind *with all major components designed, built and guaranteed by one manufacturer!* This packaged unit eliminates many costs which might otherwise be charged against the job.

In capacities from 7½ through 150 tons, the matched components of the B&G Package Liquid Cooler give a complete capacity-engineered combination of chassis, motor, compressor and automatic control obtainable nowhere else. Everything included—no extras to buy.



B&G CONDENSING UNIT

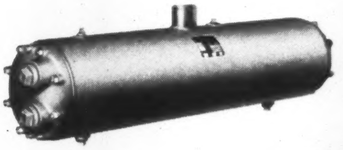
Cut-away shows construction of compressor



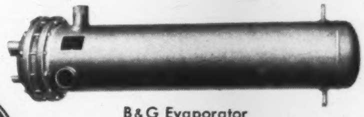
B&G CONDENSING UNIT

Here is another matched unit with all components manufactured and guaranteed by Bell & Gossett. It offers an impressive list of features, *many of them exclusive,* which make it completely outstanding. Amazingly compact as well as efficient—7½ through 150 tons.

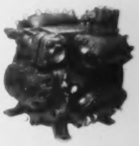
A FULL LINE OF REFRIGERATION AND AIR CONDITIONING COMPONENTS



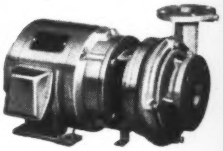
B&G Condenser



B&G Evaporator



B&G Motor Compressor



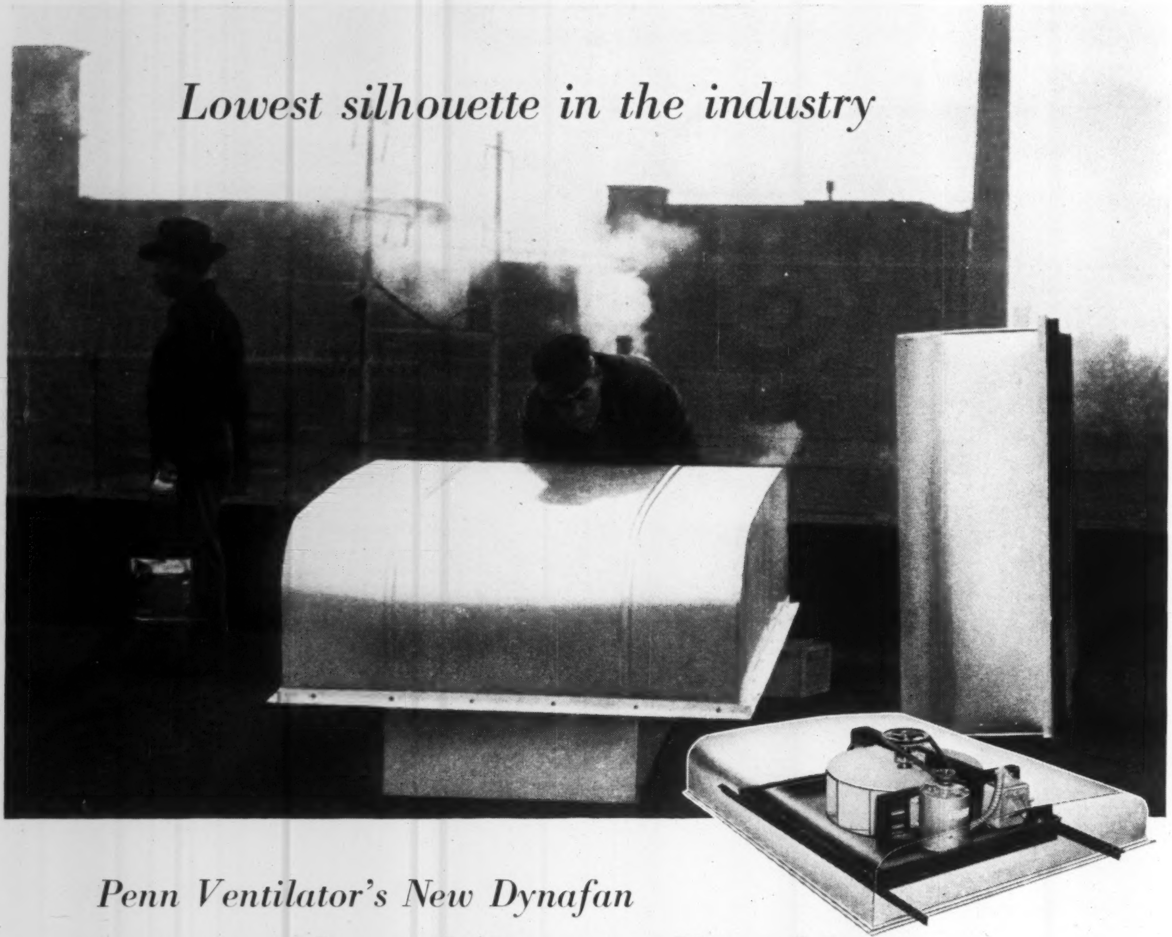
B&G Centrifugal Pumps

Reg. U.S. Pat. Off.

BELL & GOSSETT COMPANY

Dept. RFQ-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario



Penn Ventilator's New Dynafan

Lowered and Streamlined!

Low-Contour Dynafan. That's the name we've given to our new roof exhauster. It cuts almost 50% off normal roof exhauster heights . . . and its lines are cleaner, more modern. The Low-Contour Dynafan is the safest insurance that clean lines designed into modern buildings will not be compromised. And for more uniform appearance, the same modern housing is available for use as supply and relief units.

The new Low-Contour Dynafan is more than just low and clean-lined. Major engineering advances are incorporated . . . for example, you won't find the motor atop the wheel as with other roof exhausters, and you won't find the vibration-prone overhung shaft, either. Instead, noise has been cut appreciably by straddling . . . now the fan wheels are supported between sealed ball bearings located above and below the wheels. And the entire fan unit floats on vibra-sorb vibration eliminators. In addition, exact type motors to fit your particular service condition are supplied.

Get all the details on Penn Ventilator's new Low-Contour Dynafan. Call your local Penn Ventilator representative, or write to Penn Ventilator Co., Philadelphia 40, Pa.

PENN VENTILATOR CO., INC.
GOODMAN & ALLEGHENY, Philadelphia 40, Pa.
Representatives and Distributors in Principal Cities
Charter member of AMCA

RUBBER
FLEXIBLE METAL
KORFUND FLEX-HOSE

NEW FLEX-HOSE

NEWEST MEMBER OF THE KORFUND VIBRATION AND NOISE CONTROL TEAM

Now you can get complete top-to-bottom vibration and noise control from Korfund. With the addition of Korfund Flex-Hose (available in both flexible metal or rubber), our line is complete. Now you can get really smooth operation from pumps, compressors and refrigeration machines by connecting both suction and discharge lines to new Flex-Hose in order to stop transmission of vibration and noise through the rigid piping; and, by mounting the equipment on Korfund Vibro-Isolators to stop transmission through the floors and structure.

We've always recommended using flexible connectors in conjunction with our isolation mounts for efficient operation. Now we can offer you what we consider to be the best available — Flex-Hose. These quality products were designed and approved by Korfund engineers—specialists in vibration and noise control for more than a half-century.

Korfund Metal Flex-Hose is available in corrugated, seamless bronze, carbon steel, stainless steel, or monel tubing in fourteen pipe sizes from ¼" I.D. to 16" I.D. The tubing is protected and reinforced by a new unique braid providing especially high burst strengths. Maximum steady working pressures vary with size up to 1700 psi, and may be increased by as much as 75% by added braiding. Flex-Hose comes in your choice of five standard end fittings.

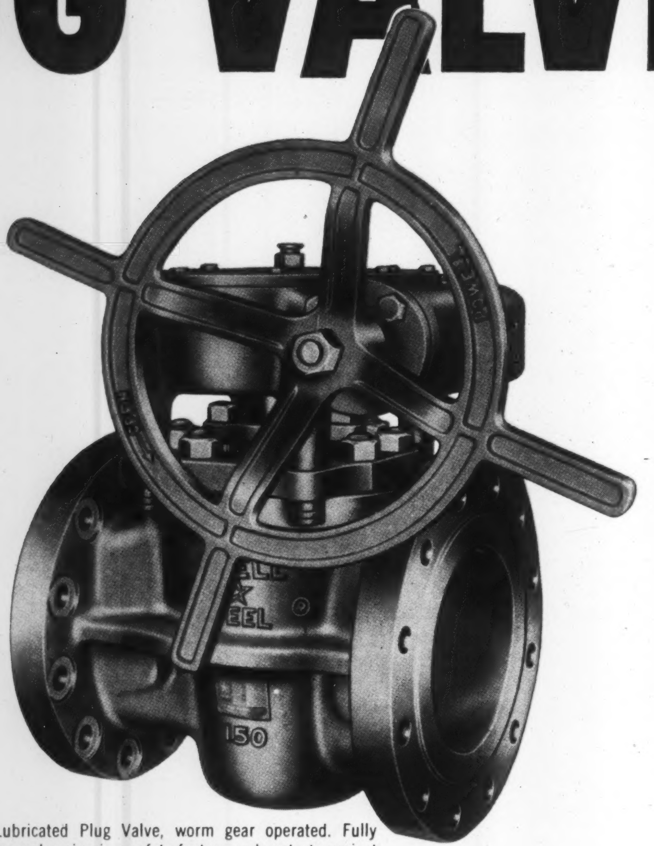
Korfund Rubber Flex-Hose consists of an inner rubber tube protected by a wire reinforced carcass and outer wrap. It is available in fifteen pipe sizes from ½" I.D. to 12" I.D. Fittings are either male threaded hex ends, or full faced integral built-in rubber flanges. Rated working pressures are 150 psi and 250 psi depending on job requirements.

Korfund Flex-Hose is shipped with a written one-year warranty and instructions. Find out more about it. Write for Bulletin 61.

For specific recommendations contact us or one of the 46 local Korfund offices. Look under "Korfund" in your local Telephone Directory on in Thomas' Register.

THE KORFUND COMPANY, INC.
VIBRATION • SHOCK • NOISE: CONTROL & MEASUREMENT
48-OIF THIRTY-SECOND PLACE • LONG ISLAND CITY 1, NEW YORK

POWELL
LUBRICATED PLUG VALVES



Powell Lubricated Plug Valve, worm gear operated. Fully enclosed gear housing is a safety feature and protects against injuries and damage from the elements and tampering.

Like all Powell Valves, Powell Lubricated Plug Valves are superior in their field . . . and have many advantages over conventional types of Valves:

- Simple design: Only three basic parts—Body, Bonnet, Plug.
- Quick, complete shut-off.
- Tapered plug assures positive seating.
- Machined surfaces of plug and body are not exposed in open position.
- Cavity-free straight passage assures streamlined flow.

Powell Lubricated Plug Valves are available in sizes ½" through 16", depending on the type required—Semi-steel 175 and 200 pounds WOG; Carbon Steel ASA 150 and 300 pounds.

Powell can also furnish Lubricated Plug Valves in other alloys on special order.

For all your valve needs, consult your local Powell Distributor—or write directly to us. Send for our new Lubricated Plug Valve Catalog, Number PV-5.

The Wm. Powell Company • Cincinnati 22, Ohio
Dependable Valves Since 1846

POWELL . . . world's largest family of valves

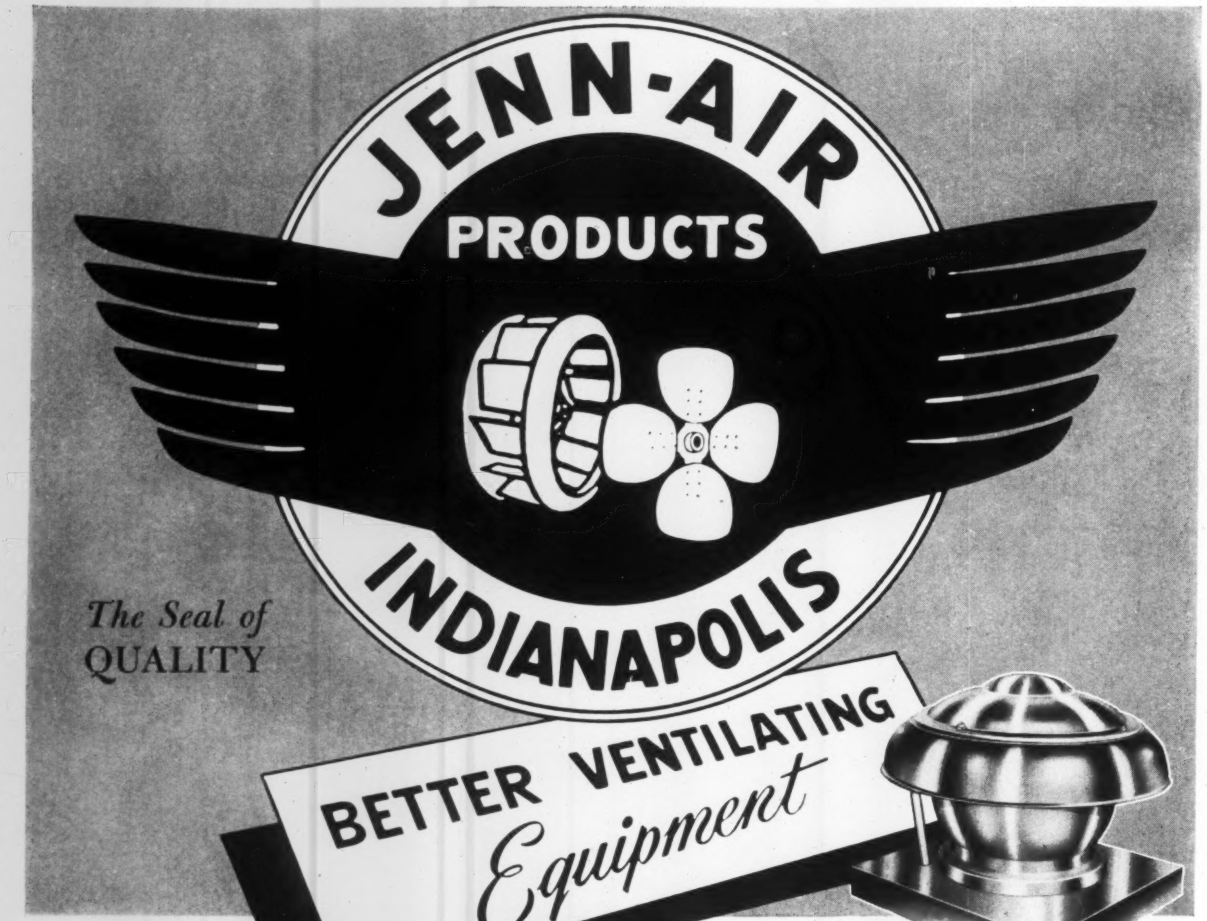
Specify ELLICOTT Storage and Pressure Vessels

WITH CUSTOMIZED CORROSION CONTROL

Stop Corrosion or contaminated contents before it starts by specifying Customized Corrosion Controlled Storage and Pressure Vessels by Ellicott.
Ellicott has successfully solved many problems involving the use of steel, steel alloys and non-ferrous metals in the fabrication of vessels and entire systems. Some of the more important special metals and alloys used are: Copper Silicon, Clad Steels, Stainless Steels, Nickel, Monel, Inconel and Aluminum. A complete line of Novelon Linings of cement, rubber, lead, copper and the new plastic linings that allow much higher heat resistance can be applied to low cost carbon steel.
Ellicott vessels with Customized Corrosion Control can solve the corrosion problems in the storing and processing of water, acid, food, chemicals, air and gaseous vapors. Send us your corrosion problem today. Representatives in major cities for Hot Water Generators • Heat Exchangers • Storage Tanks Special Linings and Metal Fabrication.

ELLICOTT
FABRICATORS INC.

Subsidiary of Ellicott Machine Corporation
CLARE & KLOMAN STS. • BALTIMORE 30, MD.



Wherever the four winds blow...
this trademark stands for

matchless power exhauster performance

Here's why . . .

Jenn-Air developed the first spun aluminum, low contour exhauster years ago. This was a milestone in exhauster design, but it was by no means Jenn-Air's last word on the subject. Product improvement is a never-ending project at Jenn-Air, and this emphasis on engineering has netted rich dividends over the years. Examples of exclusive features developed by Jenn-Air include:

- **U-spring suspension**—Compensates for both radial and lateral movement to reduce vibration and noise. 44% more effective than rubber isolaters. Unconditionally guaranteed for life!
- **Integral balance**—In addition to dynamic and static balancing of blades, Jenn-Air exhausters feature *integral* balancing of blade with motor. This is an important contribution toward further noise reduction.
- **High point of discharge**—Motor is nested in the housing to provide the highest discharge point of any roof exhauster. By eliminating the need for a high curb base, this feature also makes possible Jenn-Air's attractive "low contour" design.

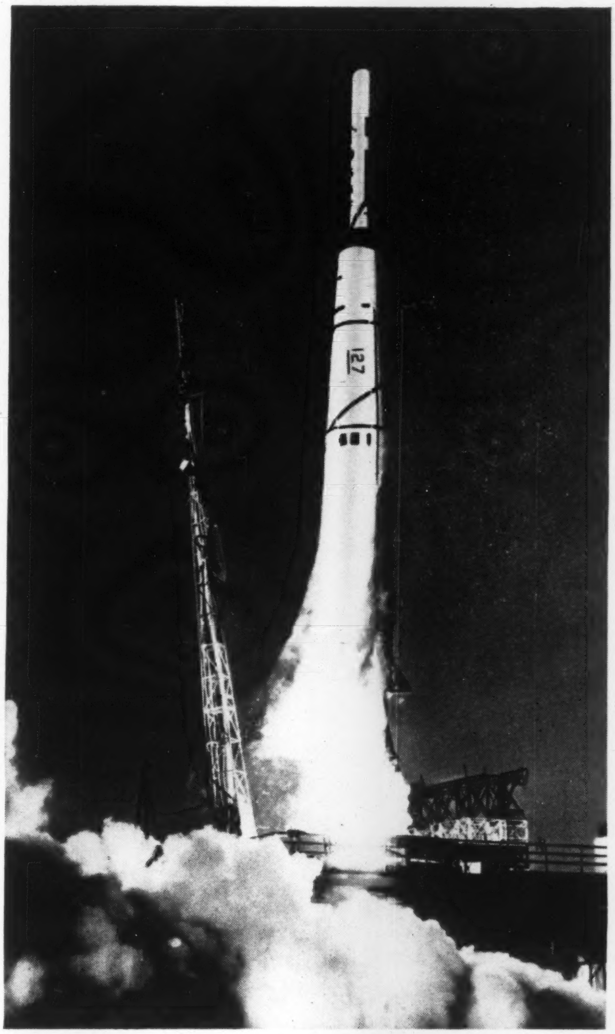
Every Jenn-Air exhauster that comes off the production line is individually tested for sound level, motor load and insulation breakdown. Only units which can pass these rigid tests are accepted for shipment. Air moving capacities range from 175 to 22,700 cfm and are AMCA-certified. Write for Bulletin 58-B.

JENN-AIR

Jenn-Air Products Co., Inc
1102 Stadium Drive
Indianapolis 7, Indiana

Member of Air Moving and Conditioning Association

In missiles and millinery shops, movies and map centers . . .



Rising slowly on a column of flame, a giant guided missile lifts from its launching pad. Air-conditioning plays an important part in the manufacture and assembly of missiles by protecting intricate parts against temperature and humidity variations.

You'll find

genetron®

SUPER-DRY REFRIGERANTS

Filling the Air-Conditioning and Refrigeration Needs of Modern America

In thousands of different air-conditioning and refrigeration applications, you can count on "Genetrons" for top performance. These refrigerants are universally accepted for use as original or replacement charge. Leading manufacturers, refrigeration engineers and air-conditioning and refrigeration wholesalers approve, specify and recommend them. They offer unexcelled quality and dryness . . . and their strict specifications are consistently *bettered* in production.

"Genetron" Super-Dry Refrigerants are available from wholesalers everywhere, coast to coast. See your wholesaler. Ask for "Genetron"!

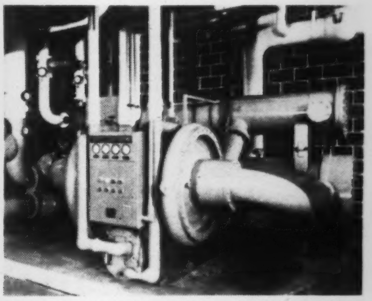
genetron 11	ORANGE LABEL	CCl_3F	**TRICHLOROMONOFLUOROMETHANE**
genetron 12	WHITE LABEL	CCl_2F_2	**DICHLORODIFLUOROMETHANE**
genetron 22	GREEN LABEL	$CHClF_2$	**MONOCHLORODIFLUOROMETHANE**
genetron 113	PURPLE LABEL	$C_2Cl_3F_3$	**TRICHLOROTRIFLUOROETHANE**
genetron 114a	BLUE LABEL	$C_2Cl_2F_4$	**DICHLOROTETRAFLUOROETHANE**

Allied Chemical

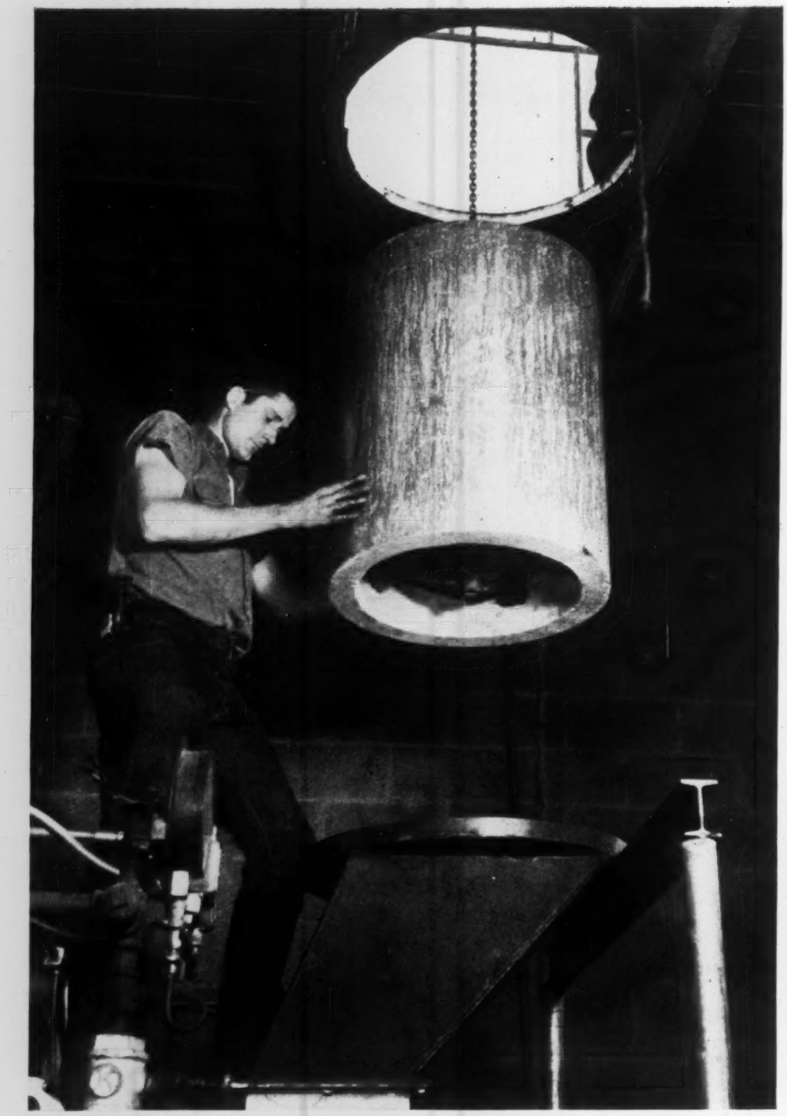
GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N. Y.

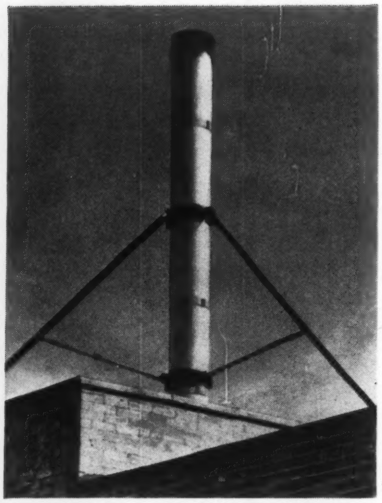
No fuss—but plenty of feathers as milady tries on one hat after another in her air-conditioned millinery shop.

Part of the show in our modern American movie theatres is comfortable air-conditioning. Movie managers have learned that the "air-conditioned" sign on a theatre marquee is good for business.

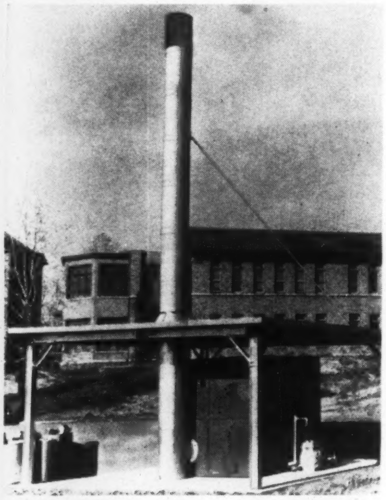


At the Army's map service center, Kansas City, Missouri, this 100-ton refrigeration unit helps control temperature and humidity. The paper, plastic and film used in map-making require precise temperature and humidity control. *The Trane Company Photo*





Van-Packer Stack, made up of Standard Sections, handles boilers and furnaces.



With Hi-Temp Sections, stack handles incinerator flue temperatures to 2000°F.

Prefabricated refractory stack goes up in a day, outlasts steel by 3 times

Van-Packer Industrial Stacks are comparable in cost with steel stacks, yet average three times greater life because they are made of special refractory material that won't corrode. The stack is available with Standard Sections for boilers and furnaces, or with Hi-Temp Sections for incinerators.

Van-Packer Stack sections are cast in three-foot lengths for easy installation. Sections have corrosion-resistant metal jacket which eliminates maintenance. Eight diameters, from 10-inch ID to 36-inch ID are available. Sections are cemented one atop another with high temperature acidproof cement, then secured with draw-up type bands.

Van-Packer Stacks are available through local Van-Packer Jobbers and Special Representatives. See "Smoke Stacks" or "Chimneys—Prefabricated" in the yellow pages of your classified telephone directory for the name of your nearest Van-Packer distributor.

Write for Bulletin IS-32-57

VAN-PACKER

Division of* FLINTKOTE *America's Broadest Line of Building Products

Van-Packer Co. 1232 McKinley Ave., Chicago Heights, Ill. • SKyline 4-4772

SEE OUR CATALOG IN SWEET'S OR WRITE FOR COPY

IS MOVING AIR YOUR PROBLEM?

BARRY

CENTRIFUGAL FANS

do the job better because they are designed to fit your special needs!

BARRY blowers represent the most dependable and economical solution to your air moving problems. BARRY can supply you with *exactly* the right blower for your specific application—all types and sizes from 6″ to 73″ impellor diameter. BARRY will give you speedy delivery on any unit—assuring you of "on schedule" completion of your project. For fastest service and highest quality centrifugal fan equipment—always specify BARRY!

Barry will be happy to quote on your specific Centrifugal Fan Problem! Write Dept. M3100.

member of air moving and conditioning association inc.

BARRY BLOWER CO.

3100 CALIFORNIA ST. N. E., MINNEAPOLIS 18, MINN.

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facts about Superior Packaged Boilers

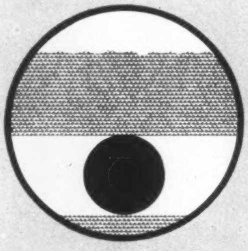
SUPERIOR'S MID-SHELL FURNACE LOCATION

protects against the two most common causes of furnace failure

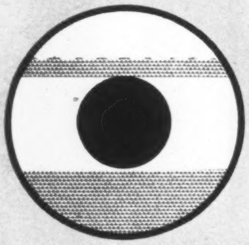
One of the often overlooked, and yet very important considerations for the purchaser or specifier of boilers of the horizontal fire-tube type is the location of the furnace in relation to the boiler shell. To a great extent this location is determined by whether the boiler is of the up-draft or down-draft type. Up-draft units usually have the furnace set low inside the shell. Down-draft units usually have a higher furnace location.

Ideally the furnace is located near the center of the shell, where it is protected from the two most common dangers which can cause bagging, blistering or complete burnout of the furnace.

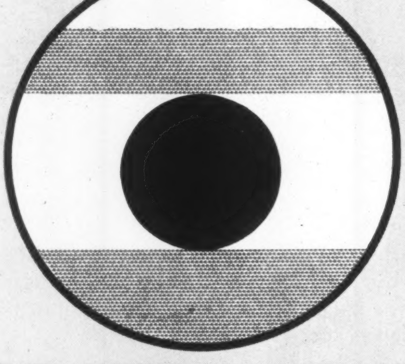
The first of these dangers is low-water. When the furnace is located too high in the shell, the covering layer of water is necessarily less, and the danger is increased. When the furnace is too low within the shell, mud and silt can deposit on the bottom of the shell and eventually bridge to the bottom of the furnace, cutting off circulation and causing a burnout of the furnace. The adjacent diagrams show the location of the furnace in other fire-tube boilers and in Superior Type C boilers. When you buy or specify a packaged fire-tube boiler consider this important fact.



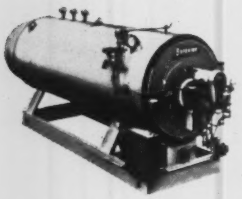
LOW FURNACE...MUD BURNOUT DANGER



HIGH FURNACE...LOW WATER BURNOUT DANGER



MID-SHELL LOCATION GUARDS AGAINST BOTH



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Completely packaged fire-tube units for capacities from 20 to 350 bhp. Rotary burners on all sizes. Induced draft for clean, quiet safe operation. Fully insulated and ready for service burning oil, gas or both in combination. Pressures to 250 psi, or for hot water operation. Other fire-tube models for capacities to 600 bhp. Write today for Bulletin 14C.

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SUPERIOR COMBUSTION INDUSTRIES, INC.
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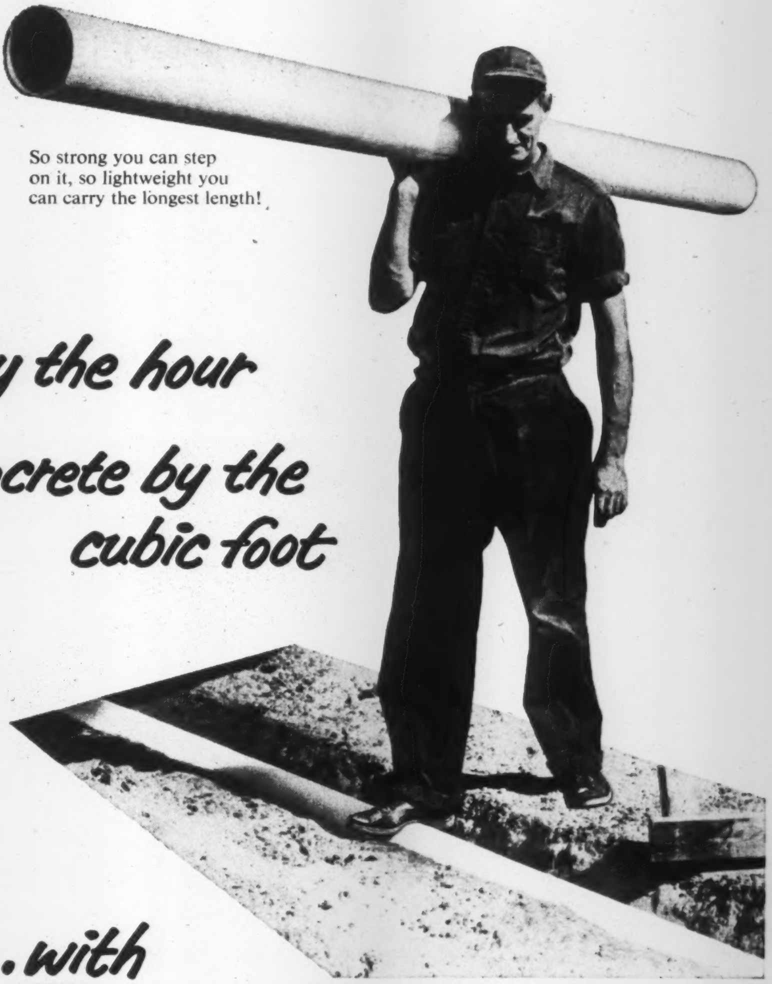
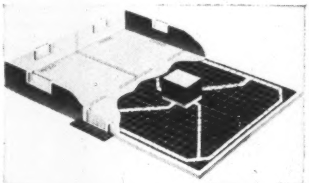


So strong you can step on it, so lightweight you can carry the longest length!

Save time by the hour ...concrete by the cubic foot

Transite Air Duct being installed in Ridgewood Homes, Inc., Worth, Ill. Clifford J. Wood, Builder: Brainerd Heating and Sheet Metal Co., Heating Contractor.

Taped joints are this easy to make, right at the job site.



You can readily install Transite Air Duct as part of the entire heating system.

...with

easy-to-install Transite Air Duct for heating and cooling systems!

Transite® offers you unmatched dollar savings for perimeter heating and cooling systems! Here's why:

First, Transite is light in weight. This means it is easy to truck, stack, and carry on the job. Easy to assemble, too . . . permanent, efficient joints are quickly made with easily applied Ductite® Tape.

NO ENCASEMENT NEEDED

More important, Transite saves substantially in both time and concrete. Transite needs no concrete encasement . . . can be laid directly on the prepared bottom. Transite won't "float". . . needs no special supports or anchoring. Just position ducts and pour concrete . . . Transite won't crush, dent, or deform.

AVAILABLE IN LONG LENGTHS

Installation is still faster and easier because of Transite's long, 10-foot lengths . . . fewer joints to be made to complete the installation. And fittings can be made right on the job . . . simply cut the pipe to shapes desired and tape sections together.

MANY HOME OWNER ADVANTAGES

Transite offers home owners long, trouble-free service. Made of asbestos and cement, it is fully corrosion-resistant inside and out, it won't flake or flap down to impede air flow . . . will never rot or give off odor. For free booklet, TR198-A, write to Johns-Manville, Box 14AA, New York 16, N.Y. In Canada, Port Credit, Ont.

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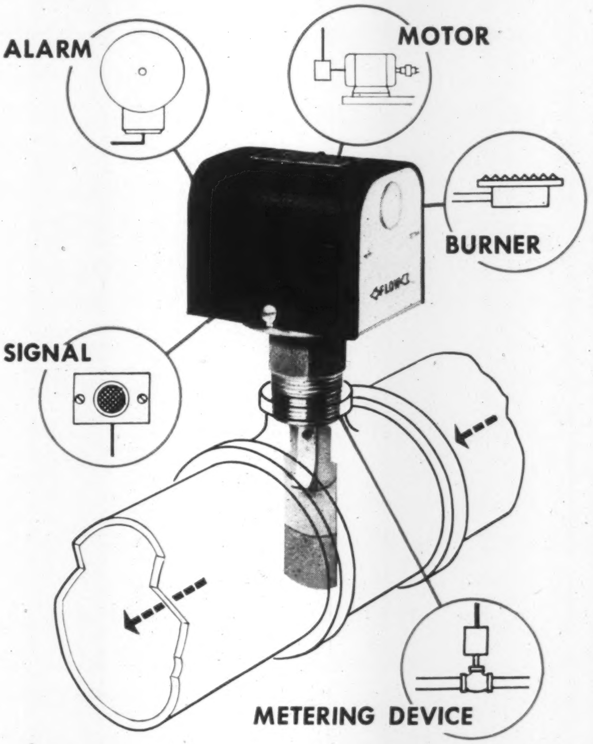
McDONNELL FS4 SERIES FLOW SWITCHES

Versatile new way to start or stop a . . .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SIGNAL
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Wherever it is important to know if a flow of liquid starts or stops, right there you have a spot for the McDonnell FS4 Series Flow Switch. It is a dependable, moderately-priced device that makes or breaks an electrical circuit when flowing liquid moves the paddle. It's an effective way to provide safer or more automatic operation, available now in compact size and price to fit a broad range of applications.

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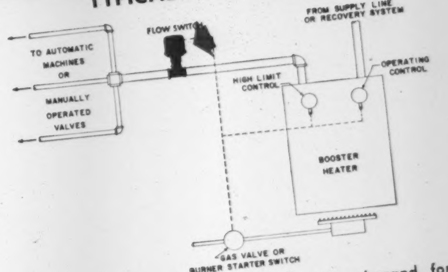
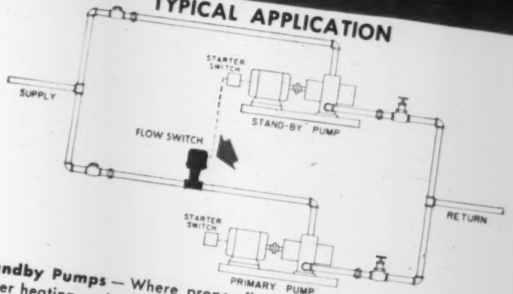
TYPICAL APPLICATION


TO AUTOMATIC MACHINES OR MANUALLY OPERATED VALVES
FLOW SWITCH
FROM SUPPLY LINE OR RECOVERY SYSTEM
OPERATING CONTROL
HIGH LIMIT CONTROL
BOOSTER HEATER
GAS VALVE OR BURNER STARTER SWITCH

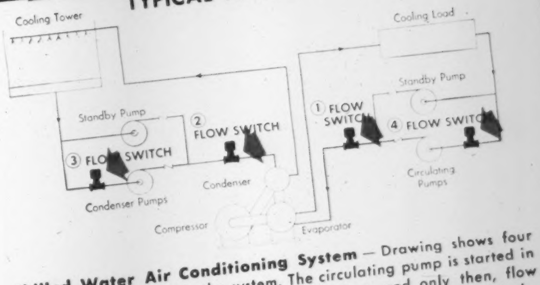
Hot Water Supply for Dishwashers — The demand for 180° water for rinsing tableware in public establishments (and for other commercial processes) frequently requires a booster heater. But the operating control on such a heater may not respond quickly enough, when a sizeable volume of water is drawn, to keep water from falling below 180°. With a flow switch in the line burner is started immediately when a draw of water occurs, to start recovery at once. When flow stops, flow switch returns control to the primary control.

TYPICAL APPLICATION


SUPPLY
STARTER SWITCH
STAND-BY PUMP
FLOW SWITCH
RETURN
STARTER SWITCH
PRIMARY PUMP

Standby Pumps — Where proper fluid flow is essential — as in hot water heating and chilled water cooling systems — a standby pump is often installed in parallel with the primary pump. In the system above, a reverse acting flow switch (breaks current with flow) is installed in discharge line from primary pump. If pump fails, and flow stops, flow switch cuts in standby pump.

TYPICAL APPLICATION


Cooling Tower
Cooling Load
Standby Pump
② FLOW SWITCH
③ FLOW SWITCH
Condenser Pumps
Condenser
Compressor
Evaporator
① FLOW SWITCH
Standby Pump
④ FLOW SWITCH
Circulating Pumps

Chilled Water Air Conditioning System — Drawing shows four flow switches installed in the system. The circulating pump is started in normal manner. When there is sufficient flow, and only then, flow switch No. 1 allows the condenser pump to be started. Similarly, flow switch No. 2 allows compressor to be started when there is sufficient flow of condenser water. Flow switches No. 3 and 4 have reverse-acting switches, automatically cut in standby pump if primary pump fails. Use of the flow switches in this system assures continuous operation, starts system in sequence, stops compressor if there is not proper circulation in system, can be used to report operation on central control panel.

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Ring-top provides a solid, generous hand-hold—more than 4" to grip, reducing risk of cylinder damage or personal danger. No more hunting for separate carrying devices!

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exclusive with Ucon BRAND refrigerants

**Ucon Refrigerants 12, 22 and 114 Are Now Available
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Full Choice of Unit Sizes to match *your* quantity needs. Ucon Refrigerants are sold in 10 and 25 pound Ring-Top Cylinders, in 145 pound and ton cylinders, in 100 and 200 pound drums, and in tank-wagon or tank-car lots.

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BRAND
refrigerants

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Ucon Refrigerant 12 Dichlorodifluoromethane
Ucon Refrigerant 22 Monochlorodifluoromethane
Ucon Refrigerant 113 Trichlorotrifluoroethane
Ucon Refrigerant 114 Dichlorotetrafluoroethane

UNION CARBIDE CHEMICALS COMPANY

Division of Union Carbide Corporation

GIANT Turbine Expansion Joints Built by BADGER

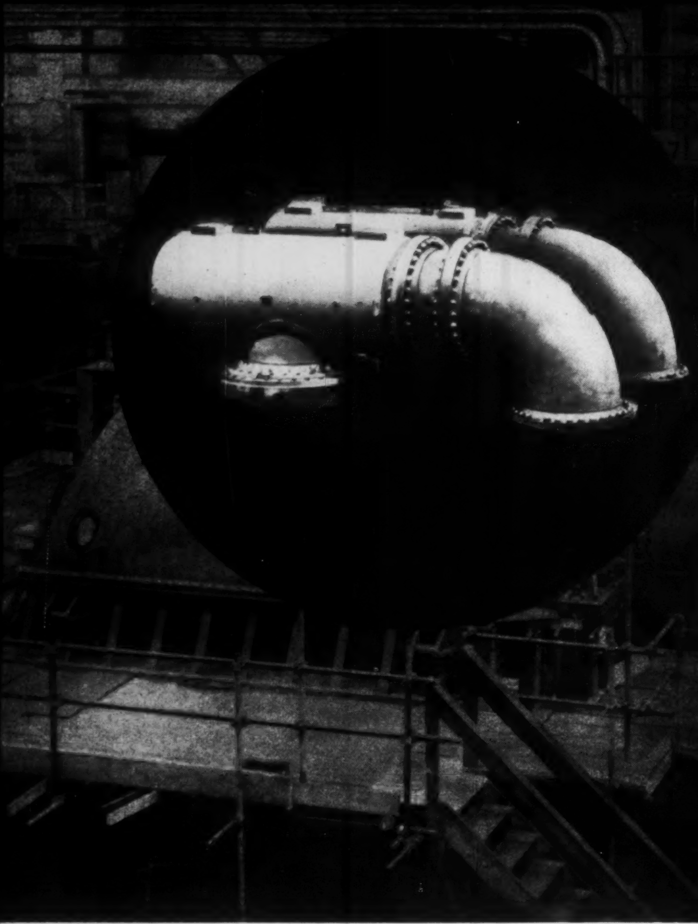
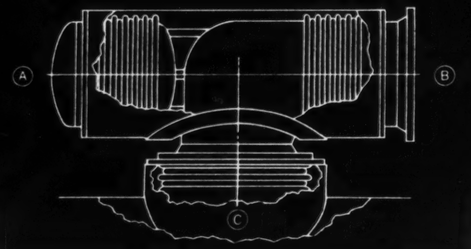


Photo shows 150,000 kw steam turbine-generator unit undergoing tests prior to shipment at General Electric's Turbine-Generator Plant in Schenectady, N. Y. Badger Expansion Assembly is clearly visible atop turbine.

Badger balanced elbow expansion assembly.



Joint A balances thrust due to internal pressure of 65-150 psi; joint B absorbs axial movement; joint C absorbs the differential expansion between the inner and outer casings of the turbine. Assemblies range in size from 36 to 42 inches in diameter.

Custom engineered assemblies include many features of Badger S-R Design

750°F steam is flashed through these turbine crossovers at speeds up to 150 ft/sec and pressures up to 150 psi.

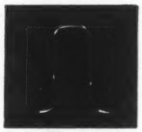
How do you protect piping and turbine casings from the stresses of extreme internal pressure and the expansion such temperature is bound to produce?

Working together, Badger and engineers at General Electric's Large Steam Turbine-Generator Department solved the problem with a new type pressure balanced elbow expansion assembly. Using two separate joints mounted in a T-shape casing (see diagram) the assembly effectively absorbs and controls axial movement. Although the device was custom engineered to General Electric's requirements, the bellows elements are constructed to the Curvilinear Corrugation design recently announced by Badger and now used in all S-R Expansion Joints.

Whether you need standard S-R Expansion Joints or custom equipment, Badger can serve your needs. Get more information — write for illustrated brochure today.

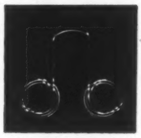
New corrugation and ring designs produce better equalization, "all-curve" flexing

Curvilinear Corrugations used in S-R Expansion Joints were developed by the Badger Research Department. Under operating pressures (white line) the new design produces more uniform movement per corrugation and natural "all-curve" flexing. Stress is reduced . . . life increased.



Series 50 corrugation cross-section

S-R Joints for higher pressures have tubular Reinforcing Rings. These new rings make metal-to-metal contact only in the "valley" of each corrugation allowing natural "all-curve" flexing (white line). Tubular shape permits greater effective flexing height which contributes to longer life.



Series 150 corrugation and ring cross-section

BADGER

S R

SERVICE RATED

EXPANSION JOINTS

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"open for discussion"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Provide Adequate Space for Industrial Ventilation Equipment

B. R. SMALL's comments ("Open for Discussion," February) to my article, *Industrial Ventilation: How to Design for Heat Recovery* (November 1958), are greatly appreciated. It is interesting to note his figures on cost for central built-up systems. These provide further proof that the larger central systems are not necessarily more expensive than the package air handling units. As he mentions, it is the operating and maintenance savings in particular which make the built-up systems such a good investment.

It is also interesting to note that main floor and lean-to fan rooms were provided in many cases for the supply systems. More and more companies are beginning to realize that adequate, accessible space is as necessary for the ventilation equipment as for the other important items of equipment which are components of a modern, efficient industrial plant.

JOHN H. CLARKE
Engineering Design Supervisor
Air Conditioning and Power
Visking Co., Div. of Union Carbide Corp.
Chicago, Ill.

Exact Determination of Odor Threshold Is Often Difficult

IN HIS ARTICLE *Winning the Air Conditioning Odor Fight; Round 2* (February), Albert B. Hubbard gives a very good description of sensory methods in evaluating odor in terms of thresholds. This makes it possible to describe the odor in a given situation, but it has its limitations.

Frequently, knowledge of the number of thresholds, without knowledge of what chemical compounds are present or the actual concentration of odor in parts per million, is useless as far as applying a method of practical odor control. This is especially true in process applications or in situations where unusual odors are present. Unfortunately, exact analytical determinations are sometimes difficult and there are even situations where it is less expensive to actually put in equipment to control odor than it is to determine the quantity of odor present.

It is entirely possible that Mr. Hubbard will touch on these matters in later articles in this series.

H. L. BARNEBEY
Barnebey-Cheney Co.
Columbus, Ohio

For Freeze Protection, Condensate Should Be Swept Away with Steam

THE ARTICLE *Why Steam Coils Freeze*, by H. W. Alyea (April and May 1958), and later comments have re-aroused my interest in this subject. Particularly, W. B. Buck's analysis ("Open for Discussion," December 1958) of various types of distributing tube design was excellent. Further, his emphasis on size balance revealed the complexity of the problem and obviously many frozen coils must directly relate to failure in design. However, my personal experience indicates that many failures are mechanical in nature and occur years after design.

Two years ago I had the opportunity to plan an installation involving 500,000 cfm of outside air. Naturally, coil freezing was considered. The engineer responsible for design had recently completed an even larger installation and was more concerned with the problem than might ordinarily be expected.

A solution that I advanced has been used in steam coil installations for dryers and occasionally on entire heating systems. In this system, excess steam is passed through the air heating coils and the condensate is carried therein to an accumulator. The excess steam and condensate separate in the accumulator and the excess steam is condensed in a downstream riser such as used with space heating.

Freeze-up protection is obtained because condensate is swept away continuously and always is in intimate contact with steam in the coil. Opposite end supply and return connections eliminate the need for any distributing tube type device. A standard steam coil may be used and the length factor becomes unimportant.

Another advantage is the elimination of the delicate balance of components explained by Mr. Buck. Balance of excess steam quantities in individual coils is attained by simple large orifices and is not critical. The system must be carefully designed, but complexity is absent. While maintenance cost is reduced, first cost may be less because of the savings with standard coils over special distributing tube types.

M. F. Lebowitz
Valley Equipment Co.
Pittsburgh, Pa.

We'll Never Run Out of Fossil Fuels If Technology Keeps Up with Demand

George W. Rusler's article *Where Are the Fuels For Tomorrow's Heating Needs Going to Come From?* (January) is the latest example of how the many energy resource articles which appear in magazines and newspapers tend to fluctuate between extremes of pessimism and optimism. Mr. Rusler appears to be a member of the pessimists.

The optimists about oil reserves virtually refuse to recognize that petroleum reserves are finite in quantity and that eventually we will reach a point where it will be economically unattractive to continue to remove crude oil from the ground. The pessimists, on the other hand, take the current inexact petroleum reserve estimates and utilize them as though they were precise measurements of the recoverable oil which we will eventually find and produce. Furthermore, the pessimists, in their efforts to dramatize their predictions, present a word picture of the world starving for energy because one of our energy sources has passed its peak.

Predicting a peak for oil production within the next 10 to 20 years is not necessarily incorrect, but there is an excellent possibility that it is wrong. Though Mr. Rusler identifies Lewis G. Week's ultimate reserve estimate of 185 billion barrels as optimistic, actually it should be classified as only moderately so. Several estimates of U. S. reserves have been presented for over 200 billion barrels and some have been made for as high as 500 billion barrels.

In all predictions, the great unknown—technology—cannot be accounted for. Pennsylvania passed a peak of production of 31 million barrels in 1891 and declined to 7 million barrels by 1921. I am sure the usual predictions of doom could be heard then as now. However, the appearance of secondary recovery made possible a second peak of 19 million barrels in 1937. Since we only recover approximately one-third of our oil by present production methods, our exploration methods are very inexact and costly, and current drilling technology can still be improved. There is plenty of room for technology to make tremendous strides in increasing our economically recoverable reserves above that which we now feel is possible.

Several other weaknesses are apparent in predicting a sharp peak of oil production in the near future. With the general use of prorationing for individual fields, it would seem that the U. S. — when it does reach its peak of production — might have a fairly long period while it remains at, or near, its peak. The sharp peak of the logistic curve may not adequately reflect this tendency. Also, it is too soon to determine whether the recent slowing down of additions to reserves is a transient economic condition or whether it is a sign of depletion. Oil exploration has always been sensitive to an economic incentive. The recent appearance of quantities of low cost, foreign oil has prevented the price of domestic crude from rising sufficiently to maintain an adequate profit incentive for domestic exploration. This, however, does not mean that there isn't domestic oil left to be found.

If we wish to continue to find and use domestic oil, we may have to pay more for it or make the necessary technologic progress. Even if the price of crude oil rises, or the price of any other energy source for that matter, it is not too critical. Since that part of final product cost contributed by the fuel used is not large, we can pay quite a bit more for our fuels than we do now and still not find it particularly burdensome.

For example, a doubling of fuel cost may only involve about a 5 percent increase in the cost of most manufactures. In other words, a real shortage of energy is very critical, but an increase in the cost of energy is not quite so serious. This means that we will probably never actually "run out" of oil but will gradually shift to less expensive sources of energy. In its declining years, petroleum will be relegated to a high cost specialty status for those who still must use it as a fuel or a raw material.

Perhaps Mr. Rusler has also been somewhat too hard on coal and oil shales. Even very conservative estimates of U. S. coal reserves indicate that coal alone could carry the energy burden of the U. S. until the year 2050 without too great an increase in cost. Synthetic liquid fuels from coal certainly could be produced at a price that is less than double what we pay now for products from crude oil. As for oil shale, again if we wish to pay the price for the tremendous development that would be required, there is probably much more oil shale to be had than Mr. Rusler indicates.

Certainly there is no room for complacency about our energy reserves. We must have adequate energy supplies at reasonable cost or our standard of living will be in jeopardy, and our modern machine-run economy could grind to halt. However, the combined energy resources of discovered and undiscovered oil, oil shales, coal, and natural gas, plus the developing technology of nuclear power, seem to offer us sufficient lead time to develop synthetic liquid fuels, thermonuclear power, and energy from the sun. However, we had better not sit around too well satisfied with our good fortune while depletion and high cost move forward with growing momentum.

JOHN J. SCHANZ, JR.
College of Mineral Industries
Pennsylvania State University
University Park, Pa.

Plant Can Expect Further Success When Cooling Tower Is Installed

JOHN VONDERHEIDE's article, *GE's 'Mill Water' Piping Saves $500,000 a Year* (December 1958), discusses an interesting project. It seems that the potable water cost is about 90 cents per 1000 cu ft. He bases his economics on how much of this 90 cent water he would have to buy if he didn't have a recirculated mill water system.

From his article it seems that the initial water is run through a thermal process, piped to a spray pond for adiabatic cooling, then pumped from the pond back to the heat transfer process. The returns are sized to pick up runoff storm water as it flows by gravity.

The runoff water reduces the amount of potable water he would otherwise buy for makeup purposes. The use of rain water is a supply of "free" water that is often overlooked. What is not clear is why the process water finally has to be wasted.

From experience I know fully well that he will be satisfied with cooling tower performances. In the Detroit area the design wet bulb temperature is 75 F — close enough to Louisville's 80 F to form the criterion to make this statement.

In my article, *Cooling Towers, Cold Water Piping Serve Process Cooling Applications* (April 1958), I mentioned an approach temperature of 8 F deg. The tower accomplishes that easily. Most of the summer the water off the tower is less than 75 F. The only times I ever saw water above 75 F were a few hours during a few days in August. The tower manufacturers will guarantee the makeup water not to exceed 0.5 percent.

JAMES C. BISHOP
Plant Engineer
Detroit, Mich.

When Should Sight Glass Be Used In Refrigerant Circuits?

THERE IS A NEED for clarification in the use of the sight glass in refrigerant circuits in which air cooled

condeners are used. If the function of the sight glass is not understood, the wrong conclusions are sometimes drawn and its use therefore actually leads to trouble.

One important thing to remember is that the sight glass is definitely *not* to be used on systems in which the evaporator is equipped with capillary tubes. This is one of the most common errors in the use of the sight glass. In most cases where it has been used on capillary tube systems, the result has been an overcharge of refrigerant being put into the system.

To understand why this can readily occur, it is first necessary to understand the manner in which the capillary tube functions in the refrigerant circuit. One of the best brief explanations of the capillary tube is given in the following quotation taken from the service handbook of Tecumseh Products Co.

"*The Capillary Tube*: Since many units today use a capillary tube, a brief explanation of this device should be important. The use of the capillary tube in refrigeration is not new. As a matter of fact, some of the earliest of the refrigeration units used a restrictor similar in action to the capillary. This took the form of a small orifice or nozzle or short tube.

"The function of the capillary is to act as a vapor lock and not a liquid control. The volume of vapor per pound of refrigerant is many times the volume of the liquid. As an example, we may take the volume of saturated refrigerant No. 12 vapor at 86 F compared to the volume of liquid at the same temperature. The vapor occupies 0.389 cu ft per lb, whereas the liquid is 0.0124 cu ft per lb; the volume of gas is 31 times as great as the liquid. Therefore, under a given pressure difference, the capillary will pass many times the weight of liquid that it will pass of the gas. The capillary length and bore are adjusted so that it will just pass the required amount of liquid under the normal differences of pressure in the system. Should the pressure increase, the liquid passes through the capillary faster than it condenses. However, as soon as the gas starts to flow, the tube acts as a restrictor reducing the weight of refrigerant passed in a given time and allowing liquid to again build up at the capillary entrance. On the other hand, if the pressure difference is lowered, due to lower room temperature perhaps, the liquid will condense faster than the capillary will carry it away and it backs up slightly into the condenser.

"Also, at the exit end of the capillary, gas bubbles are formed. This is obvious from the pressure and temperature gradients. At the entrance end the liquid is at saturated temperatures and pressure corresponding to the condenser conditions. In the evaporator we find a lower saturated temperature and pressure. At some point in between, toward the exit end of the capillary, evaporation must start to lower the main body of liquid to the evaporator temperature. Further, lowering the evaporator pressure reduces flow and increased evaporator pressure increases flow.

"Thus, the capillary is self-compensating over a considerable range of temperature and pressure on high and low sides much like an expansion valve."

Therefore, under conditions of high head pressure it is normal and proper that some gas be flowing along with the liquid in the liquid line and passing through the sight glass. The addition of refrigerant to clear up the bubbles results in abnormal operation in which some of the excess refrigerant collects in the bottom of the condenser and cuts off some of the condenser heat transfer surface, thereby further increasing the head pressure, and the balance of the excess refrigerant causes liquid to return to the compressor and creates the risk of damaging valves.

When the cooling system includes an evaporator equipped with an expansion valve, it is permissible and optional to install a sight glass. If used, the sight glass should be installed in the liquid line near the evaporator and after the filter-drier. However, the sight glass should not be used to charge the empty system initially or to charge an empty system after pumpdown, unless the system is operating under full load conditions.

The only recommended way to charge the system under light load conditions is to accurately weigh the charge. Under conditions of light load, the flow of refrigerant is less than normal and if the system is charged to the point where the sight glass is clear and liquid just covers the condenser outlet, then under full load conditions the flow of refrigerant will be higher and some gas will enter the liquid line at the condenser outlet. This is not supposed to occur in an expansion valve system and if it does it reduces the capacity of the system.

If the sight glass cannot be used to charge the system, what can it be used for? The sight glass, when used together with a suction pressure gage is useful in trouble shooting after the system has once been charged.

If a situation is encountered in which the suction pressure is low and the sight glass is clear, this indicates that there is a restriction in the suction line. However, if the suction pressure is low, but the sight glass is cloudy, this indicates one of three things: a low charge, a restriction in the liquid line, or too high a pressure drop in the liquid line. If there is a severe restriction in the liquid line, it will show a sharp temperature drop beyond the point of restriction. All accessible portions of the liquid lines should be checked for this refrigeration effect, especially the filter-drier which may have become clogged. A visual inspection of the line will show such things as flattened or kinked tubing. A check should be made to determine that the line is not too small or too long, which will cause too much pressure drop and create gas bubbles in the sight glass. An evaporator installed more than 20 ft above the condensing unit may cause too great a pressure drop. A check should be made before installing an evaporator more than 20 ft above the condensing unit.

LYLE K. HUHN
Manager, Field Engineering Services
Janitrol Heating & Air Conditioning Div.
Surface Combustion Corp.
Columbus, Ohio

READER ASKS —

"Will Anti-Freeze Harm Boilers, Greatly Affect Heat Transfer?"

"We are installing packaged hot water heating boilers in five buildings remote from the boiler rooms. The buildings are to be heated with a hot water heating system filled with 42 percent ethyl glycol solution. We are using an anti-freeze with the following analysis:

Ethylene glycol, wt, percent min.	90.3
Diethylene glycol, wt, percent min.	5.0
Total glycols, wt, percent min.	95.3
Borax (decahydrate), wt, percent	—
Borax (pentahydrate, wt, percent	1.9
Water, wt, percent max.	2.8
Dye, grams per gal	0.3
pH, 30 percent solution	—
pH, 50 percent solution	7 to 8
Reserve alkalinity	14.2 to 15
Freezing point, F	
50 percent solution	−34
30 percent solution	—
Specific gravity, 77 deg at 60 F	—
Specific gravity, 25 deg at 25 C	1.118 to 1.122

"The boiler manufacturer has withdrawn the warranty on the boilers because the system is using this solution instead of water.

"We would like to know if any of your readers have had any experience using an anti-freeze in boilers, and if so, if it will harm the boilers or materially affect the heat transfor."—R.T.F.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

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question of the month

What Vapor Transmission Rules Apply When Planning for Dehumidification?

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with an answer that has been received from a reader. Earlier answers appear in the January and February 1958 issues. Other answers or comments for publication are invited. This month's new question appears on page 100.

> *"If we consider a sealed room in which the air is at a low dewpoint temperature, and we suddenly open a relatively small door to the outside where there is a high dewpoint temperature.*
>
> *"a) At what initial rate will water vapor enter the room per sq ft of opening?*
>
> *"b) Does this rate vary with time elapsed after the door is opened? If so, what is the relationship?*
>
> *"c) How can the time required for the entire room to reach outside vapor pressure be calculated in terms of room volume and dimensions? It is assumed that there is no air movement through the doorway and that inside and outside air are at the same temperature such as 85 F with an initial vapor pressure difference of 0.4 in. Hg.*
>
> *"d) If it is now assumed that air flows outward through the doorway, at what velocity must it flow to prevent inflow of water vapor?*
>
> *"Answers and comments from other readers on this will be greatly appreciated."—H. P. W.*

Transmission Rate Depends on Vapor Pressure Difference, Inlet Distance

THE RATE of vapor transmission into the room depends on the vapor pressure difference and the distance from the room inlet that the vapor has to travel within the room. Assuming that the door was opened softly so there was no air circulation to affect the instantaneous vapor transmission rate, a permeability factor for still air and a basic equation are used to calculate the rate:

$$W = [U\ (\Delta P)]/L$$

where:

W = transmission rate, gr of vapor per hr per sq ft
U = permeability, perms, or gr per hr per sq ft per in. of media thickness per in. Hg
L = media thickness, in. (approaches zero at the first instant)
ΔP = vapor pressure difference, in. Hg.

The initial rate is infinitely high since the thickness of the still air barrier is infinitely small. By giving the air a linear dimension, an average rate can be easily found for transmission through that dimension. For the first inch of thickness, the average rate is:

$$(120 \text{ perms})\ (0.4 \text{ in. Hg})/1 \text{ in.} = 48 \text{ gr per hr per sq ft}$$

The time that this average rate exists can be figured by using the difference of moisture content of the 1 in. by 1 sq ft element of permeated air and a similar element of outside air.

At the same temperature, a difference in moisture content is practically directly proportional to a difference in vapor pressure. At 85 F, 0.4 in. Hg difference equals 60 gr per lb difference in the properties of the air of the room and that outside. These differences can be found along the 85 F isotherm on a psychrometric chart. If unlike temperatures were used in the problem, the moisture content difference could still be found on the psychrometric chart.

The specific volume of air at 85 F is 13.7 to 14.3 cu ft per lb, depending on the relative humidity. At 50 percent RH, the specific volume is 14.0 cu ft. The 1 in. element of air is 1/12 cu ft and weighs 0.006 lb. This amount of air requires the following grains of moisture to increase the vapor pressure 0.4 in. Hg.

$$(0.006)\ (60 \text{ gr per lb}) = 0.36 \text{ gr}$$

At the rate of 48 gr per hr, this element of air requires the following amount of time for more complete permeance:

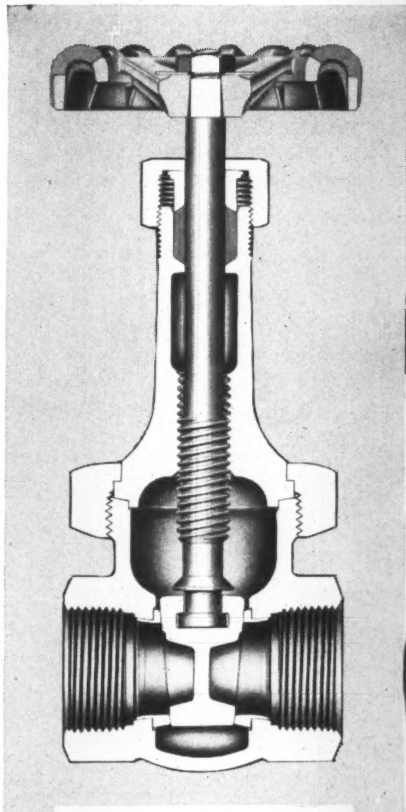
$$0.36/48 \text{ gr} = 0.0075 \text{ hr, or about } \tfrac{1}{2} \text{ min.}$$

Assume a 21 sq ft doorway in the middle of a 9 × 9 × 9 ft room, as shown in Fig. 1.

The time required for vapor transmission to various points in the room changes considerably by calculating average rates for the various distances by the previous formula. After transversing across the length of the 9 ft long room, the average rate is:

$$[(120 \text{ perms})\ (0.4 \text{ in.})]/[(9 \text{ ft})\ (12 \text{ in./ft})] = 0.44 \text{ gr per hr per sq ft}$$

In a 9 ft length of room air, a foot square, or a 9 cubic element, the amount of moisture required to increase the vapor pressure 0.4 in. is:



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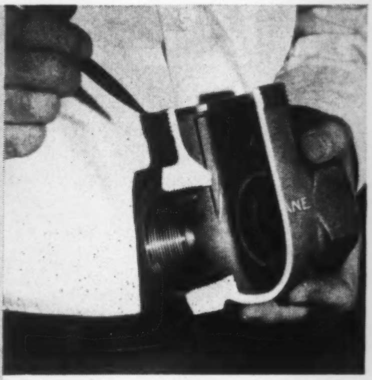

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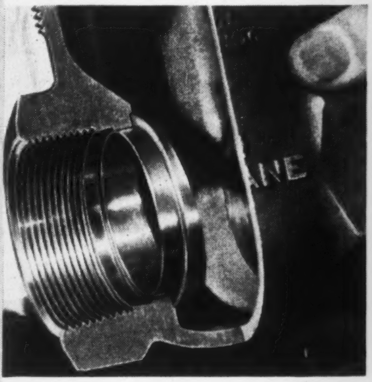

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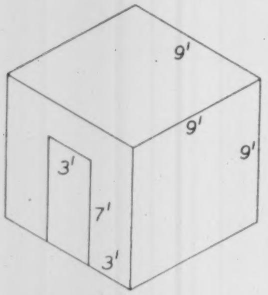


Fig. 1

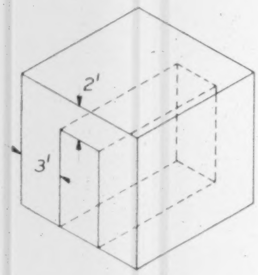


Fig. 2

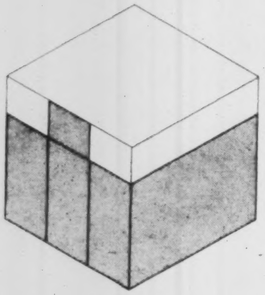


Fig. 3

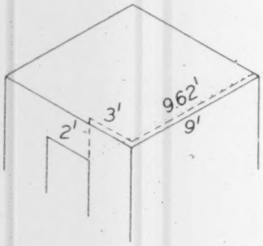


Fig. 4

$$\frac{[(9 \text{ cu ft})\ (60 \text{ gr per lb})]}{14 \text{ cu ft specific volume}} = 38.5 \text{ gr}$$

If the 81 sq ft side of the room were open, the vapor could be visualized to permeate through an 81 sq ft wall of 9 ft thick, still air or a 729 cu ft element. Although 81 times as much air is permeated as in the 9 cu ft element, there is 81 sq ft of open area which divides 81 out of the following calculation. In each case, 87 hrs is required for complete permeation since the air is 9 ft thick.

$$[(81)\ (38.5 \text{ gr required})]/[(81 \text{ sq ft})\ (0.44 \text{ gr per hr per sq ft})] = 87 \text{ hr}$$

Since there is a doorway rather than an open wall, two approaches are used to visualize inflow of water vapor. The first treats the 189 cu ft of air covered by the 21 sq ft doorway as the initial element of air completely permeated.

After complete permeation, only 3 ft more of air thickness need be permeated from the sides of this 189 cu ft element. There is a 2 ft thick element on top of the initial element. However, the side elements will take more time for complete permeation. The time required for the side elements is:

$$[[(3 \text{ ft})\ (60 \text{ gr})]/[14 \text{ specific volume}]]/[[(120 \text{ perms})\ (0.4 \text{ in.})]/[(3 \text{ ft})\ (12)]] = 9\tfrac{1}{2} \text{ hr}$$

The remaining corners adjacent to the 3 and 2 ft elements shown in Fig. 3 take very little time for complete permeation as shown with the 1 in. layer of air. The total number of hours by this approach is about $87+9\frac{1}{2}=96\frac{1}{2}$ hr.

In my second approach, I will not complete an element at a time. The area permeated divides out of the time formula so this need not be determined.

The thickness of permeation can then be found by determining the maximum geometrical distance from the door opening to the inside of the room for complete permeation. The distance would be shorter for partial permeation.

In the room illustrated in Fig. 4, the maximum distance is computed as follows:

$$\sqrt{2^2 + 3^2 + 9^2} = 9.62 \text{ ft}$$

The time required for complete permeation along the diagonal path from the inlet to the corner can be calculated:

$$[[(9.62 \text{ ft})\ (60 \text{ gr})]/[14 \text{ specific volume}]]/[[(120 \text{ perms})\ (0.4 \text{ in.})]/[(9.62 \text{ ft})\ (12)]] = 101 \text{ hr}$$

The time required in this approach agrees closely with the element approach. However, this is believed to be less burdensome to calculate and more accurate.

The formula used may be labeled:

Moisture change capacity/Average permeation rate = time required

As the permeation path (9.62 in the above case) is decreased, the rate increases and capacity decreases so the time required decreases. In this case, rate plotted *vs* time is a function of the square.

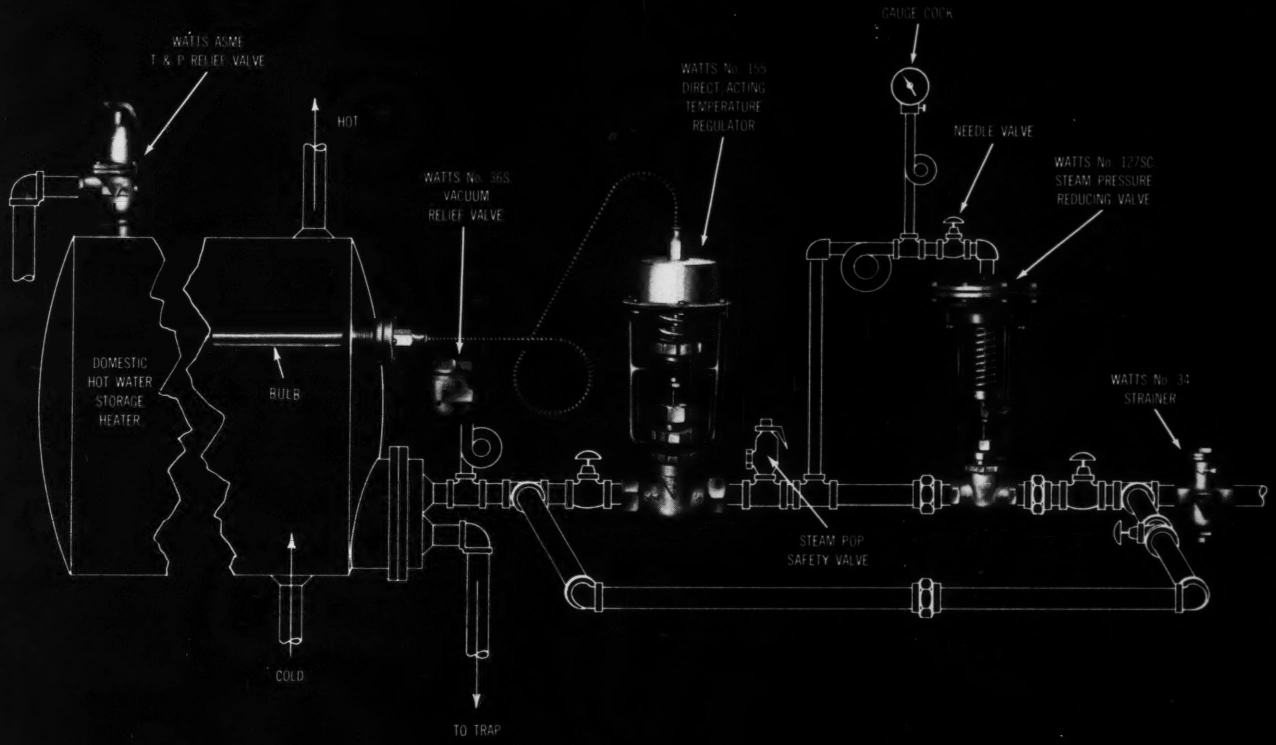
I believe that a small airflow out of the room would prevent an inflow of water vapor when the door is open.

An excellent article, *The Effect of Unbalanced Air Pressure on Permeance*, by F. A. Joy and D. R. Fairbanks, appeared in the June 1956 issue of Heating, Piping & Air Conditioning. The range of airflow given in the article was from zero to 800 gr per sq ft per hr, or zero to 1.5 ft per hr. The permeable substances measured were porous membranes which contained much air. The article concludes that when air flow, passing through the membranes against force of vapor pressure, is in the opposite direction of vapor pressure, vapor transmission is reduced and may be reversed.

Air at a velocity of 5 fph through the 21 ft square doorway is equivalent to 105 cfh. This volume is 0.15 room air changes per hr, so the room would be under very little positive pressure if the door were closed and the fan left on. Therefore 105 cfh of outside air must be conditioned to the properties of room air to make up the doorway loss. When the door is closed, positive pressure is useful against vapor leaks through cracks in the walls of the room.

In research work, the permeable space would normally be constructed to simplify the rate equation for exact determinations of transmission. More laboratory research is needed to formulate the vapor rates in still air and various air flows. However, many field application problems can be solved with the information available today.

William Walker
Development Engineer
Research Products Corp.
Madison, Wis.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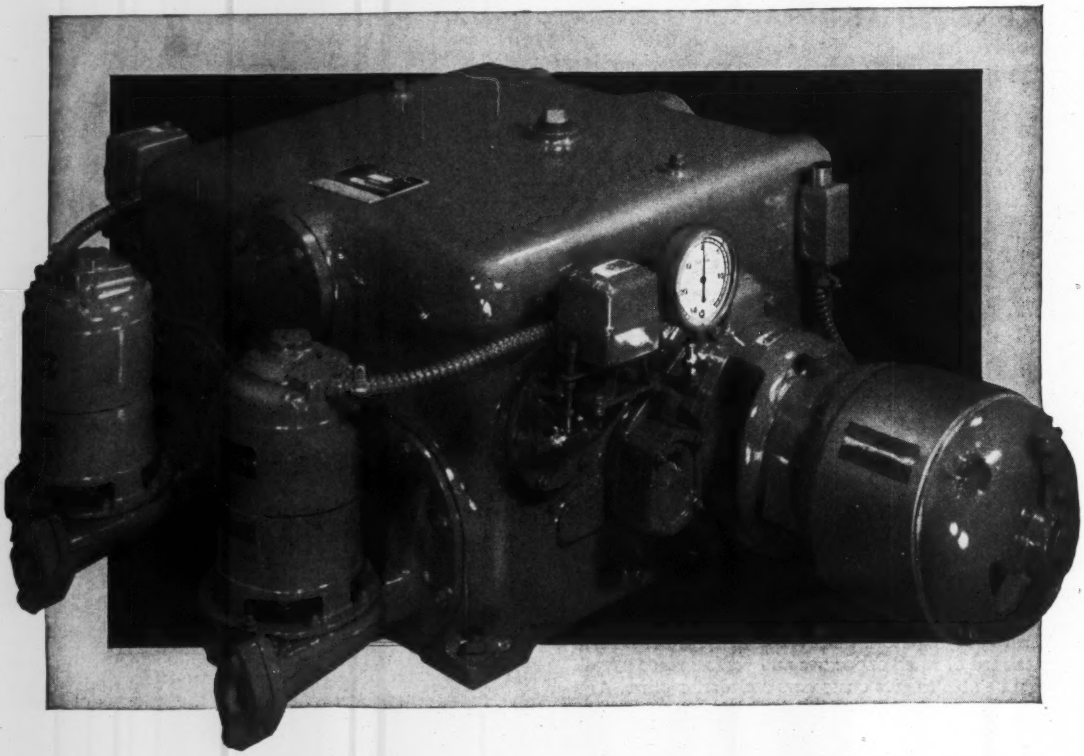

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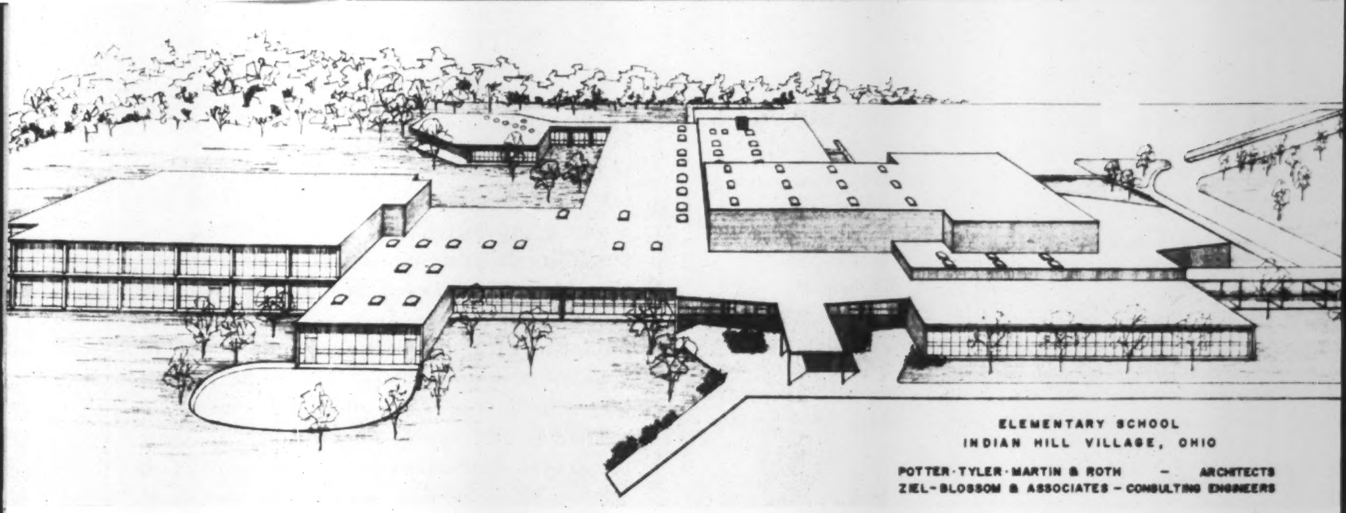
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High Temperature Water Heats New School

. . . using ceiling-mounted tubular radiant heating elements. Two-fan ventilation system admits desired air quantities

BY J. S. BLOSSOM
Ziel-Blossom & Associates
Consulting Engineers

RECENT TRENDS in school heating and ventilating have been so strongly directed toward first cost considerations that certain basic design objectives have been overlooked. It would be well, therefore, to review these objectives and determine (1) how to best accomplish these requirements, and (2) how to do this on a long term economic basis.

The primary function of the heating and ventilating system is, of course, to protect the health and safety of the occupants. Maintaining a reasonable degree of comfort has been a secondary consideration in school environment. However, many educators have pointed out that a comfortable environment tends to raise the teaching and learning standards. Therefore, the typical school classroom needs a heating and ventilating system which must meet the following conditions:

1) Concentrated people load—creating problems relating to odors, susceptibility to dust particles, and dissemination of infectious diseases

2) Wide daily and seasonal load variations

3) Large percentages of glass exposure

4) Relatively low mean radiant temperature effect, even in mild weather, due to glass area

5) Wide variations in load from outer exposure to interior of room. In many cases this requires heating at the outside walls while the interior of the room is cooled.

Persons occupying the classroom need to have their body heat losses controlled in a manner that recognizes the effect upon the occupants of this large glass area and the mean radiant temperature of the enclosure. Since approximately 60 percent of the body heat loss is in the form of radiation at the usual 72 F room temperature, it is apparent that the maintenance of a comfortable environment would require that this heat loss be controlled by the addition of radiant energy to the enclosure that would heat the exterior wall and cool the interior of the room at the same time.

Lay Groundwork for Design

Radiant energy can be added at the outside surface of a room in various ways. However, consideration of economic factors leads us to conclude that the problem is best served if we can reduce the total amount of heat transfer surface required. Within reasonable pressure and temperature limitations, the cost of the heat transfer surface involved will be almost directly proportional to the required area. Since the output of radiant energy from the surface is a fourth-power function of the temperature differentials, it is apparent that significant reductions in the surface required will be made by raising the temperature of the heating media.

Conventional temperatures of 200 F for hot water were used as a starting point in this design several years ago. This temperature has been gradually increased as our experience and knowledge provides solutions to design, installation, and cost problems. We are now designing for hot water temperatures of 340 F to 400 F. The use of water at these temperatures has made it possible for us to use simple tubular radiant heating elements. These are suspended in a manner similar to light fixtures and present great advantages from the standpoints of flexibility, economy, and neat appearance.

Weigh Merits of Central, Unit Type Systems

In determining the classroom ventilation system to provide both year 'round ventilation and interior room cooling as the space may demand, we have considered the use of both central systems and unit type systems. It is fundamental, since we are going to rely upon the use of outdoor air for cooling, that the system be so designed that this may be accomplished in fact.

To do it effectively requires more than the addition of an outside air connection to a fan system, and more than the provision for outside air and recirculated air dampers under some control point. In order to introduce a relatively large percentage of the total air circulated into the classroom space as outdoor air for the purpose of cooling, we must provide a positive means for exhausting an equivalent air quantity.

This will require, in the case of "central" systems, that we use the two-fan system arrangement employing a separate supply fan and return-exhaust fan. Where "unit" ventilating systems are used, the installation of a complete exhaust system would be required. This exhaust system would have incorporated within it the necessary dampers interlocked with the "unit" ventilating systems to provide for the exhausting of air equivalent to the outdoor air introduced by each "unit" system.

It is more practical, economically, to attain a higher quality product in the installed system by designing a "central" ventilating system with larger component parts. The equipment is then of such physical size that it is accessible for cleaning and maintenance.

● Reasons why high temperature water heating for schools should be considered are economy of installation and operation, and flexibility in meeting varied loads common in schools, as pointed out by Mr. Blossom in this article. He suggests the use of an independent ventilation system to meet the ventilation requirements. The large elementary school (68,774 sq ft of floor area) described in this article has heating and ventilating systems designed to accomplish the objectives of providing separate radiant heat, supplied by a high temperature water system, to regularly occupied spaces with an independent central ventilation system.

Mr. Blossom, a graduate mechanical engineer from Lawrence Institute of Technology, has had many years of extensive and varied experience in the design and installation of heating, piping, and air conditioning systems for all types of industrial, institutional, process and commercial applications. He is a registered professional engineer in Ohio, Michigan, and Kentucky.

Electrostatic filters should be employed. In lieu of some direct means of bacteria control, the use of a central system is a step in the right direction since it presents the possibility of treating the air in some manner for the control of these conditions at a later date if not at the time of original installation.

Systems using ceiling radiant elements with high temperature water and central ventilation have been designed and placed in operation in Michigan and Ohio over the last several years with highly satisfactory performance records.

Detail School's Heating, Ventilating System

The following is a description of a large elementary school having 68,774 sq ft of floor area. The heating and ventilating systems have been designed to accomplish the described objective of providing separate radiant heat to regularly occupied spaces with an independent central ventilation system. The central ventilating systems were designed for the installation of electrostatic filters. Bids were taken on this item as an alternate. The school board decided to defer the installation of these filters until a later date due to other economic pressures.

The Indian Hill Elementary School near Cincinnati, has a modified campus type layout. The main two-story classroom wing consists of 12 classrooms, each approximately 30 × 34 ft in size. Separate rooms are provided for gymnasium, auditorium, student dining area, music room, and library. (This is somewhat unusual in current elementary schools, but this particular school is to be used for numerous community functions on a year 'round basis.) The two kindergarten classrooms are in a separate wing, but are connected to the main building by an enclosed corridor. In general, utilities are located in a walking height tunnel which follows the corridors.

Two high temperature water generators, each with a capacity of 3,400,000 Btu per hr and fired with No. 2 oil, are installed in the basement equipment room. The oil burners, fuel oil storage, and fuel handling systems are set up to burn No. 5 oil at any time. Either of the hermetically sealed centrifugal generator pumps handles 124 gpm of water into the generators.

The HTW flows from the generators to a three-way valve. A portion flows from this valve into the heating system mains, the remainder circulating through the 2 in. bypass line, mixing with recirculated system water, and returning through the sediment separators back to the generator pumps. This loop is independent of the system loop so that the water temperature leaving the generators is maintained at the level required to heat domestic hot water and to prevent internal condensation from occurring in the generator. This would happen if the HTW system were to be operated under reset control at a low water supply temperature under light load.

Each system pump handles 104 gpm of water made up of a mixture of HTW from the generators (determined by the position of the three-way valve), plus recirculated water from the system. This water is discharged to circulate through the various heat-using elements of the system. The three-way valve is actuated by the outdoor temperature to reset the temperature of the water supplied to the system.

Since this school is to be used for community functions on a year 'round basis as well as for school activities, it was decided to have the system pumps, generator pumps, and HTW generators installed in pairs to provide standby and breakdown facilities. Each of the pumps has sufficient capacity to handle the full pumping requirements of the system. Each generator has been selected to carry 60 percent of the total design heat load of the building.

Pressurize HTW System with Nitrogen

The HTW system is pressurized by the direct application of nitrogen from standard 2000 psig nitrogen tanks to the 575 gal compression tank. The nitrogen provides the necessary artificial atmosphere to maintain system pressure above the saturation pressure corresponding to the particular water temperature leaving the generators.

The use of nitrogen instead of steam permits separate control of the artificial atmosphere from the generation of heat within the system. It is extremely simple to apply, is noncorrosive and nontoxic, and is inexpensive.

The nitrogen in the system is neither used nor consumed as such. Once the system is properly sealed and leakproof, it requires only negligible makeup from the storage tanks. We prefer to supply the nitrogen to the compression tank to a predetermined pressure level and then to close off the hand valves on the nitrogen storage tanks. Our experience has shown that these systems can be made tight enough to make this practical.

Design for Tightly Sealed System

All piping in the building is Schedule 40 black iron. Joints are either welded, brazed, or flanged. We try to keep flanged joints to a minimum and permit no screwed joints anywhere in the entire system; the reason, of course, to make the system as tightly sealed as is practical.

Fittings are either 2000 lb socket weld or 300 lb malleable brazed. Where flanged joints are used it is extremely important that flexible metal gaskets be used which maintain a leakproof joint as the piping system expands and contracts with changes in tempertaure while the pressure remains at a constant level.

By maintaining a tightly sealed system, it is possible and practical to operate with what amounts to one charge of nitrogen for pressurization and one charge of water. Once the initial testing and leak repairs have been made, the system should be filled with water and sealed. Automatic makeup water should not be used on this size of system. Instead, a manually operated positive displacement makeup water pump should be provided. A water meter determines how much water is used to fill the system. If water is continuously added, the meter will indicate the quantities so used and show the necessity of locating and repairing the necessary leaks.

Under these conditions of leakproofness, the constant water charge contained in the system will become neutral as the dissolved oxygen present reacts to completion with some of the iron in the system. Once this occurs the system remains completely neutral and noncorrosive. Since the artificial atmosphere of nitrogen is an inert gas and since the water becomes neutral, the life of all parts of the system is greatly lengthened.

The HTW system is designed to supply water at a maximum temperature of 400 F at which it will be maintained at a pressure of 300 psig. Since the saturation pressure of 400 F water is 247 psia, it is impractical to operate the system at an appreciably higher water temperature without raising the pressure over 300 psig. The increase in cost to design the piping system for these higher pressures would not be justified since the total system water flow is but 104 gpm. Note that a conventional hot water system would circulate from 500 to 800 gpm depending upon design temperatures used. This consideration of pressure limitation would bear further investigation on a system 20 or 30 times larger.

The classrooms are heated by tubular radiant heating elements using the HTW directly. These are suspended from ceilings in a pattern matching the light fixtures and at the same mounting height. They are fabricated of nominal Schedule 40 steel pipe $\frac{3}{4}$ to $2\frac{1}{2}$ in. in diameter and finished with a heat resistant gray enamel. An aluminum reflector, 6 in. wide along the top, controls the radiation from the upper surface of the tubular element into the space. It also prevents dirt smudging of the ceiling or roof deck above the heating element. Water flow through a typical 30 by 24 ft classroom is 1 gpm.

HTW is supplied directly to four forced flow heaters at building entrances, and also to two banks of tempering coils and eight banks of reheat coils. These coils have steel or red brass tubes welded or brazed to headers of similar material and mounted in galvanized steel casings. Connections on all coils have beveled weld ends. The coils are hydrostatically tested to 600 psig.

Relative Safety at Point of Use

One of the significant features of HTW is its relative safety at point of use. For example, if a break occurs in an HTW line, a mixture of water and steam is discharged to atmosphere. Since the temperature of the water is well above its vaporization point at atmospheric pressure, the energy in the water is used to convert part of the water from the liquid state into the vapor state.

The quantity of heat available is sufficient to vaporize only 20 to 25 percent of the HTW present. Due to the pressure in the system, the mixture of steam and water will be ejected initially at a high velocity. Since the pressure is maintained independently by a fixed quantity of nitrogen in the compression tank, the pressure will fall rapidly and the velocity of ejection will drop to a low value very quickly.

When the 25 percent of the water vaporizes, it obtains this heat energy from the accompanying 75 percent of the water. The heat content of this water is reduced by that heat which is used to vaporize the 25 percent. For HTW at 400 F the resulting emission temperature of the mixture is between 120 and 130 F.

This reaction has been observed by running actual laboratory and field tests to determine this effect.

Supply fan No. 1 of the central ventilation system discharges air through a series of ductwork in the tunnels to the kindergartens, classrooms, library, and student dining area. This fan system, containing filters, heating coils, outdoor and recirculated air dampers, and space for future cooling coils, is located in the mechanical equipment room. This is a basement room under the food storage area.

Each classroom is supplied with a maximum of 1000 cfm of air through a thermostatically controlled volume damper which operates from full-open to 50 percent closed. The thermostat opens the damper upon a rise in room temperature and provides cooling for the interior of the classroom. Air temperature in the supply duct is controlled from a submaster duct thermostat operating a three-way valve on the heating coil. This thermostat is reset from a master outdoor thermostat to vary the duct discharge temperature from 55 to 70 F as the outdoor temperature varies from 55 to zero F.

TABLE 1 — TABULATION below is summary of cost of each contract and its square foot unit cost for construction of Indian Hill Elementary School. Bids on project were taken in January 1958; completion is scheduled this spring

Contact	Total cost	Cost per sq ft
Architectural	$ 776,620	$11.30
Heating	101,200	1.47*
Ventilating	75,500	1.10
Plumbing	84,390	1.23
Electrical	87,650	1.28
Totals	$1,125,360	$16.38

*If standby equipment is omitted, cost is $83,200, or $1.21 per sq ft.

While the basic room heat loss is met by the radiant panels, the final room temperature is maintained by the air handling system. Lighting and human heat loads always impose a cooling load on the interior of the room.

Since the quantity of air handled by this fan will vary according to the position of the individual volume dampers, it has inlet vane control operated from a static pressure controller. Return air from the spaces served by supply fan No. 1 is conducted to the underground tunnel system. The tunnels are then exhausted by a separate fan which has a bypass damper arrangement permitting it to handle variable quantities of air at a fixed speed. Exhaust fan dampers operate in conjunction with the supply fan outdoor air damper to remove the same quantity of air that is introduced as outdoor air. The control of this system is set up so that 100 percent outdoor air can be provided for cooling the building under suitable weather and load conditions.

Supply fan No. 2, located in a basement fan room under the locker and shower room area next to the gymnasium, supplies a mixture of outdoor and recirculated air to the gymnasium, auditorium, music room, and offices. Each of these four areas has individual reheat coils which are thermostatically controlled from the respective area for control of space temperature. Also, the offices are provided with a single row of the tubular radiant heating elements along the outside wall.

Separate exhaust fans serve the auditorium and gymnasium areas. Their operation is coordinated with supply fan No. 2 so that they exhaust air in proportion to the outdoor air being introduced.

Both supply fan systems are equipped with renewable media dry type mechanical filters in galvanized steel retainers. The combined capacity of the supply fans is 66,500 cfm and the combined capacity of the exhaust systems is 59,850 cfm. Also located in the tunnel is an exhaust fan connected through a central duct system to exhaust air from all toilet rooms.

The ventilating system was designed so that air conditioning for the complete building can be added by the installation of the necessary refrigeration cycle.

Architects for the school were Potter, Tyler, Martin & Roth. Ziel-Blossom & Associates were the consulting engineers for the mechanical and electrical systems. The heating and ventilating contractor was The E. J. Nolan Corp. ⌗

Locate Industrial Air Handling Systems For Efficiency, Easy Maintenance

. . . Engineer must work closely with building architect

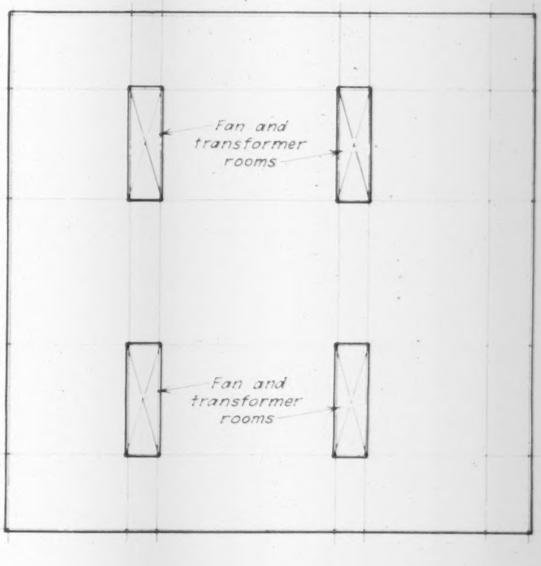
BY H. E. ZIEL
Associate
Albert Kahn Associated Architects
and Engineers, Inc.

A MOST IMPORTANT factor in the design of an air handling system for an industrial plant is the location of the equipment in relation to the area to be ventilated. Due to production or office requirements of certain areas, both present and future, fan room locations must be selected that will not interfere with the usable floor space. At the same time, the air handling equipment should be as close to the area to be served as is practical.

The architect is tempted to assign these equipment rooms to leftover spaces which do not fit in the satisfactory arrangement of manufacturing or process layouts. Many times these room locations are a great distance from the areas to be served. As a result, they not only require more power to overcome the added static pressure imposed on the system, but more offsets, sharp duct turns, etc., may be required to reach the desired areas.

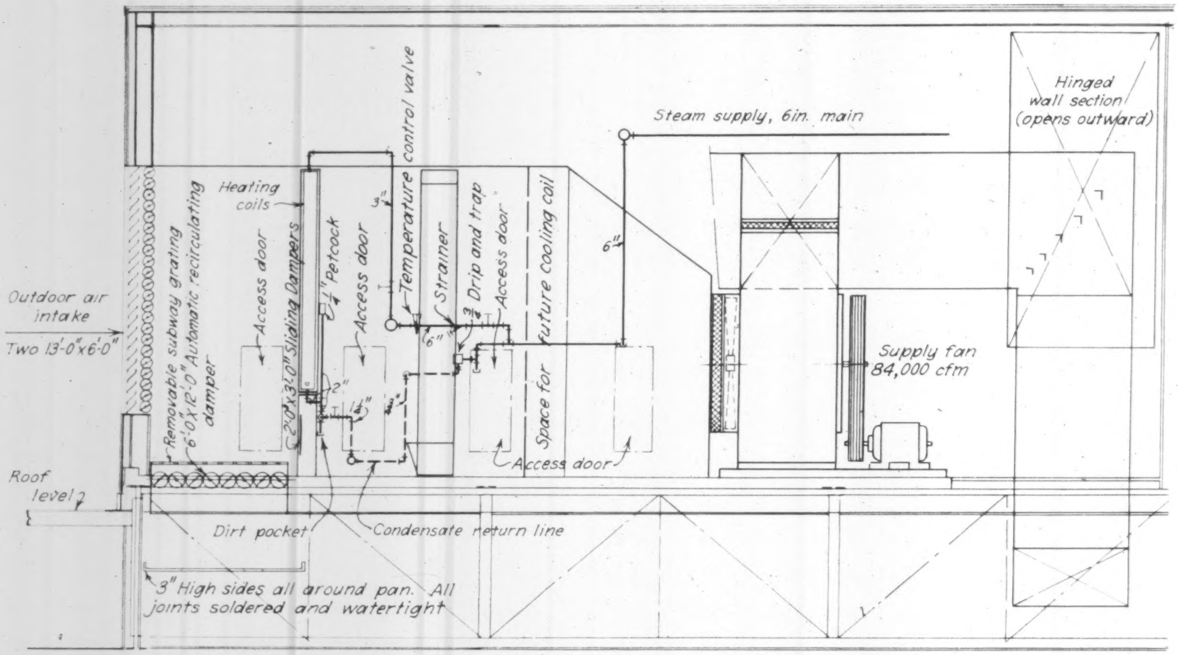
It is therefore most important that the engineer work with the architect in the early stages of the design of a building to determine the most advantageous place or places to locate the air handling equipment.

On this and the following pages are illustrated some efficient locations for industrial air handling system equipment rooms.



1 AIR HANDLING EQUIPMENT rooms for industrial buildings should be placed in locations most suitable for efficient operation and maintenance of the equipment. The typical industrial plant has one story, permitting placing of the equipment in fan rooms on the roof, on platforms in truss spaces below the roof, or on mezzanine platforms suspended from the roof trusses or supported by columns (if the lesser head room does not interfere with the usable floor space). At right is shown the arrangement of fan rooms on the roof of an engine plant. The rooms are placed in positions to reduce the duct distribution systems to a minimum and provide a simple and inexpensive method of air recirculation. Details of a fan room are illustrated in Fig. 2 on the next page

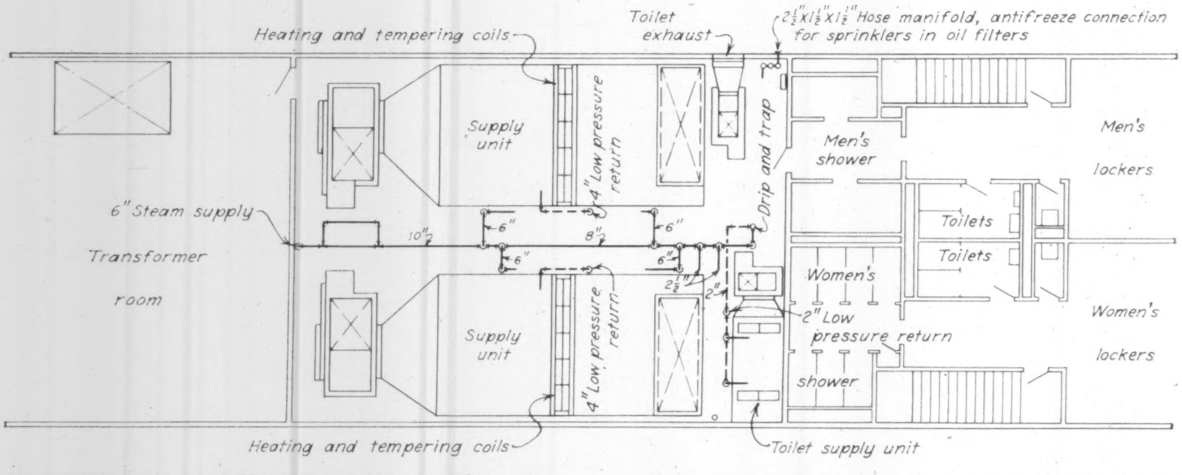
Rooftop fan discharges air into truss-space ductwork



Outdoor air intake
Two 13'-0"x6'-0"
Removable subway grating
6'-0"x12'-0" Automatic recirculating damper
Heating coils
Access door
2'-0"x3'-0" Sliding Dampers
$\frac{1}{4}$" Petcock
Access door
3"
Temperature control valve
2"
1$\frac{1}{4}$"
Strainer
6"
$\frac{3}{4}$ Drip and trap
Access door
Space for future cooling coil
Access door
Steam supply, 6in. main
6"
Supply fan 84,000 cfm
Hinged wall section (opens outward)
Roof level
Dirt pocket
Condensate return line
3" High sides all around pan. All joints soldered and watertight

2 EACH FAN ROOM consists of a motor driven fan unit which draws in outdoor and building recirculated air through heating coils and air filters, and discharges the air into a duct distribution system located in the truss space below the roof. Temperature control is obtained by recirculating sufficient air from the building to maintain a 40 to 50 F mixed air temperature. The final delivered air temperature is controlled by a room thermostat actuating a modulating steam valve supplying the heating coils

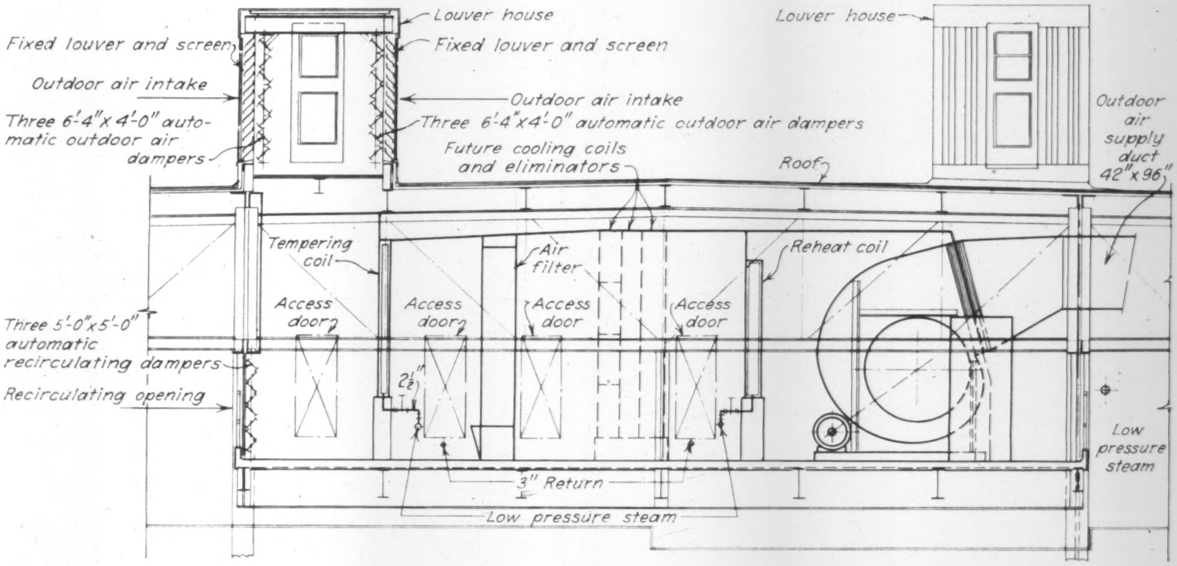
In continuous equipment room, each unit



Heating and tempering coils
Toilet exhaust
2$\frac{1}{2}$"x1$\frac{1}{2}$"x1$\frac{1}{2}$" Hose manifold, antifreeze connection for sprinklers in oil filters
Supply unit
4" Low pressure return
Drip and trap
Men's shower
Men's lockers
6" Steam supply
Transformer room
10"
6"
8"
6"
6"
6"
2$\frac{1}{2}$"
2"
Toilets
Toilets
Women's shower
2" Low pressure return
Women's lockers
Supply unit
4" Low pressure return
Heating and tempering coils
Toilet supply unit

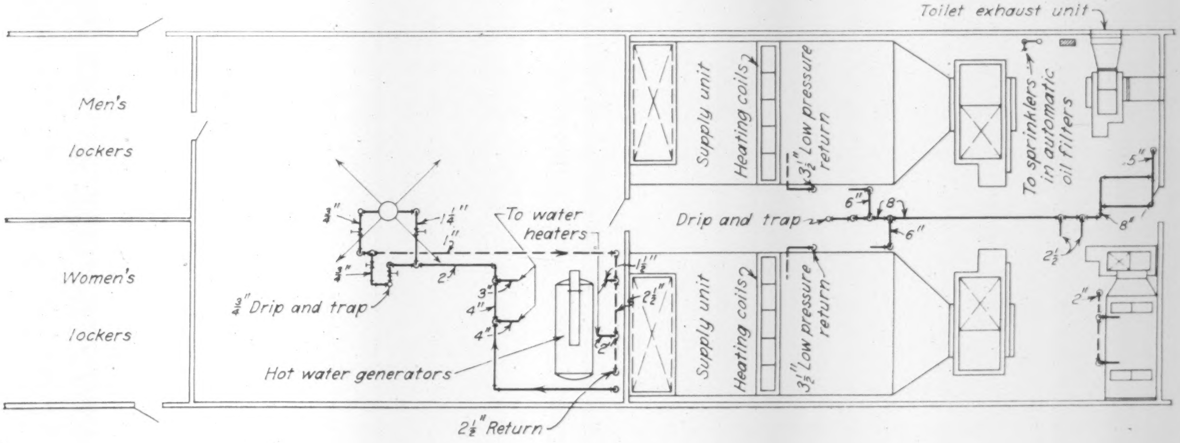
4 CONTINUOUS EQUIPMENT ROOM simplifies maintenance requirements, as each unit is easily accessible. Usually, the air handling equipment does not require the complete area, and the remaining spaces can be used for transformer rooms, motor con-

In large plant, series of mezzanine-mounted fan units gives best air distribution pattern


Louver house
Fixed louver and screen
Fixed louver and screen
Outdoor air intake
Outdoor air intake
Three 6'-4"x4'-0" automatic outdoor air dampers
Three 6'-4"x4'-0" automatic outdoor air dampers
Louver house
Future cooling coils and eliminators
Roof
Outdoor air supply duct 42"x96"
Tempering coil
Air filter
Reheat coil
Access door
Access door
Access door
Access door
Three 5'-0"x5'-0" automatic recirculating dampers
Recirculating opening
2½"
3" Return
Low pressure steam
Low pressure steam

3 ONE PREFERRED METHOD for installing air handling equipment serving a large manufacturing area is shown here. This installation includes a series of fan units located on a mezzanine balcony under the roof. The multiple number of units gives a uniform air distribution pattern through the entire plant

is easily accessible for maintenance


Toilet exhaust unit
Men's lockers
Women's lockers
Supply unit
Heating coils
3½" Low pressure return
To sprinklers in automatic oil filters
5"
6"
8
8"
6"
Drip and trap
2½
2"
¾"
1¼"
1½"
¾"
2"
To water heaters
1½"
2½"
3"
4"
4"
2"
¾" Drip and trap
Hot water generators
2½" Return
Supply unit
Heating coils
3½" Low pressure return

trol centers, employees' locker rooms, toilet room facilities, and other uses

‡

WELD SAMPLE can be removed from tight location near flange by drilling. Integrated sampling program, besides reducing safety hazard, is definite economic factor in operation of system

WELD PROBER saw is another way to remove weld probe specimens. Program should include removal of one specimen each from about 30 to 50 percent of pipe-to-pipe joints involving wrought materials

Weld Probe Sampling Are Still Your

BY HELMUT THIELSCH
Metallurgical Engineer
Grinnell Co., Inc.

"ALL CARBON-MOLYBDENUM steel piping is unsuitable for high temperature service above 800 F and should be replaced."

This misinformation, born of a few engineers not properly versed on the metallurgical aspects of the subject,

● Piping failure due to graphitization has long been a bugaboo to power companies using carbon-molybdenum steel steam piping systems operating at temperatures above 800 F. Actually, severe graphite formation, such as would cause these failures, is the exception rather than the rule, occurring in less than 2 percent of the carbon-molybdenum joints in these systems with their first 10 years of operation. Potentially severe cases of graphitization can be caught early in their development by following a program of periodic sampling of joints. Where sampling reveals graphitization to a dangerous degree, rehabilitation can be accomplished by solution heat treatment, gouging out the graphitized zone and depositing a new weld, or by replacement of the carbon-molybdenum material with a chromium-molybdenum alloy steel not considered susceptible to graphite formation.

Since early 1954 the author has been the metallurgical engineer for Grinnell. In this capacity he is in charge of the company's industrial piping laboratory. As a member of various ASTM, AWS, ASME, and other technical and code-writing committees, he is in close contact with the latest techniques in welding and pipe fabrication. He has authored over 70 technical and research articles on welding, pipe fabrication, and metallurgical subjects.

Programs of Graphitized Piping Best Guarantee of Safety

. . . of carbon-molybdenum steel steam piping systems

has filtered through to various operating power companies and led some of the managements to be unduly afraid of existing carbon-molybdenum steel steam piping systems. The purpose of this article is to correct this erroneous impression.

A little more than a year ago, two unexpected failures caused by graphitization occurred approximately two weeks apart in a steam power plant. In the first failure an 8 in. long crack opened in the graphitized heat affected zone of a forged reducer connecting a 12 in. OD boiler lead to the main steam header. The failure immediately resulted in emission of a large volume of superheated steam.

The second failure occurred in a forged reducer at the turbine stop valve which ruptured in the graphitized heat affected zone and caused the power plant to fill with steam within seconds.

The forged reducer sections which failed were made of carbon-molybdenum steel normally carrying steam at 935 F and 1325 psi. It was known, of course, that carbon-molybdenum steel under these service conditions could be susceptible to graphitization. In fact, graphitization sampling programs had been conducted periodically since 1949.

At the time of the two failures, approximately 20 percent of the butt welds had been sampled in the piping system, in which three boilers were interconnected with 14 turbines. In accordance with normal practice the samples had been evaluated by bending suitable test bars and by metallographic examination. All of the joints which were found to contain graphite and those which were in similar locations were rehabilitated either by a solution heat treatment in which the graphitized area was heated to about 1750 F to dissolve the graphite particles, or by gouging out the graphitized zone and depositing a new weld, or by replacement of the carbon-molybdenum material with a chromium-molybdenum alloy steel not considered susceptible to graphite formation.

Because of the two unexpected severe failures, the several main steam units involving carbon-molybdenum steel piping were shut down and have been replaced with chromium-molybdenum steel piping.

Normally, this would be considered an extremely costly procedure not ordinarily found necessary where a planned metallurgical sampling program is undertaken involving periodic sampling and sound metallurgical analysis. However, this plant had been in operation at 935 F for more than 100,000 hr. Since graphite formation and growth tend to increase with temperature, a more rapid rate of graphitization was considered likely in the rehabilitated joints than would ordinarily be expected in more conventional power plants where carbon-molybdenum steel piping systems operate at temperatures usually below 910 F.

Because of the 935 F service temperature, management felt that replacement of all carbon-molybdenum steel materials ultimately would be necessary. The decision for replacement also recognized that the system served exclusively an atomic isotope producing plant, where the replacement cost of the power plant piping system represents a relatively small amount in comparison to the cost of the whole plant installation.

In the many weld probe sampling programs involving commercial power plants operating at temperatures of 910 F or below in which I have been involved, potentially serious cases of graphitization have been detected in their earlier stages. Recommendations on the basis of extensive experience have permitted a balanced rehabilitation program which has helped to maintain a proper level of safety in the piping system. This has not necessitated

"EXTREMELY SEVERE" graphitization in heat affected zone is evidenced by cracking present in these two weld probe specimens the complete shutdown of all plant operations. By comparison, the cost of such a program is quite insignificant.

How Critical Is Graphite Formation?

Severe graphite formation is by far the exception rather than the rule. Statistically, less than 2 percent of carbon-molybdenum weld joints in steam piping service at temperatures between 800 and 910 F have reached a "severe" degree of graphitization within the first 10 years of service. The operating conditions at 935 F are too isolated to permit a conclusion as to a greater susceptibility at the higher temperature. The several cases where cracking has occurred in graphitized piping were interpreted as "extremely severe." In every case where cracking occurred, bend ductility has correlated well with metallographic evaluation. Bend tests of weld joints containing "extremely severe" graphitization generally developed cracking upon bending to only a few degrees.

The correlation between microstructures of graphitized weld joints and the bend test results normally correspond to the following angles:

Metallographic evaluation	Bend angle, deg
None	180
Very mild	180
Mild	90 to 180
Moderate	50 to 90
Heavy	30 to 50
Severe	15 to 30
Extremely Severe	Below 15

Only instances of "severe" or "extremely severe" degrees of graphitization are generally considered cause for immediate concern. In such cases, the graphitized zone should be cut out immediately. A "heavy" and in some cases "moderate" degree of graphitization is considered to be approaching a "critical" level which should require consideration for a proper rehabilitation program during an early normal shutdown period. Rehabilitation of joints showing "mild" graphitization in the heat affected zone may also be advisable, depending on the past length of operational service and contemplated future intended service, the service temperature, the previous history of graphitization, the number of affected joints and the degree of graphitization in these, and other factors.

Although less than 2 percent of the weld joints in steam power piping systems under the service conditions mentioned would be considered as causes for immediate concern, any failure of these may have such disastrous consequences that the detection of the "severe" and "extremely severe" conditions of graphitization should be considered almost mandatory.

At the same time, it is desirable to determine the overall level of graphitization (or its absence) in the various wrought, forged, and cast materials involved in steam piping systems.

An intelligent evaluation of the metallographic and bend test results permits continued satisfactory performance of the carbon steel and carbon-molybdenum steel materials for the intended life of the steam power unit.

How Many Samples?

Ordinarily, the Metallurgy and Piping Subcommittee of the Edison Electric Institute considers a safe evaluation of graphitization in a carbon steel or carbon-molybdenum steel piping system in service at about 800 F to consist of a weld probe sampling program in which three samples are removed at 120 deg intervals around the circumference of each pipe or valve joint.

Due to the relatively limited time available during normal shutdown periods of power plant station units, such an extensive program is rarely practical or even economical.

On the other hand, the removal of only two or four weld probe samples from a main steam piping system containing about 20 to 40 weld joints is not enough to permit any kind of conclusion as to the operating level of safety of the steam piping system. In a number of power plants where a spot-check consisting of the removal of only two or four weld probe samples failed to reveal any evidence of graphitization, subsequent more thorough examination of additional weld probe samples showed that a number of joints had been graphitized to more critical degrees.

Graphitization studies are essentially statistical in that a certain number of weld joints must be examined in order to establish a *level of soundness* of the piping system on the basis of which a future course of examination can be recommended. Ordinarily, about 12 to 20 samples from the average power plant operating unit would be considered the minimum necessary before an opinion should be formed on a particular steam piping system or unit.

Such a program may, in fact, neglect to reveal a weld joint containing a particularly severe degree of graphitization. It also may not show up other types of defects which may be present only in certain areas around the circumference of specific joints, as for example, severe shrinkage cavities in cast valve bodies.

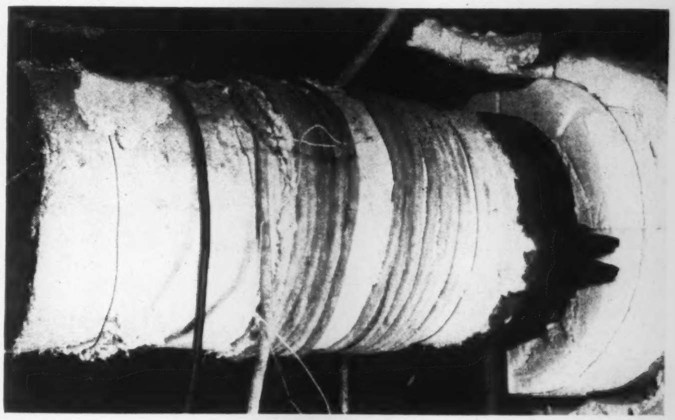
Nevertheless, where careful selection of the joints to be weld probe sampled has been made by properly experienced personnel, it is rather unlikely that there may be one severely graphitized joint which has not been sampled while *all* of the sampled joints show *no* graphitization.

If, in this initial sampling program, a number of joints in wrought, forged, or cast materials are found to contain moderate or more severe degrees of graphitization, then it is advisable to conduct a rather thorough graphitization sampling program at the next operational shutdown of the system in order to establish the "degree of graphitization" in each joint in the susceptible types of materials.

Sample 30 to 50 Percent of Joints

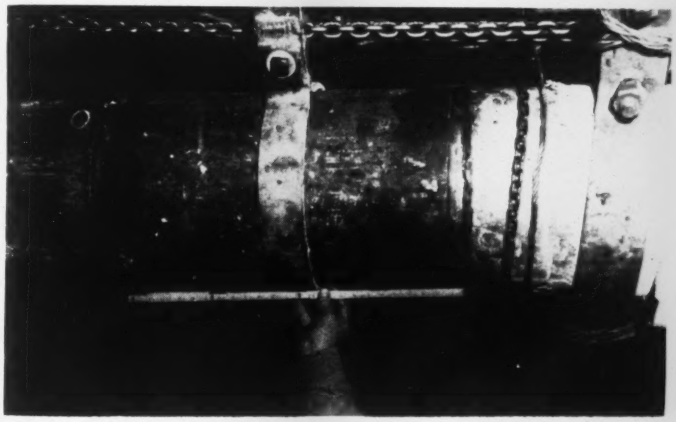
The initial sampling program should include the removal of one weld probe specimen each from approxi-

Three ways to rehabilitate carbon-molybdenum joints

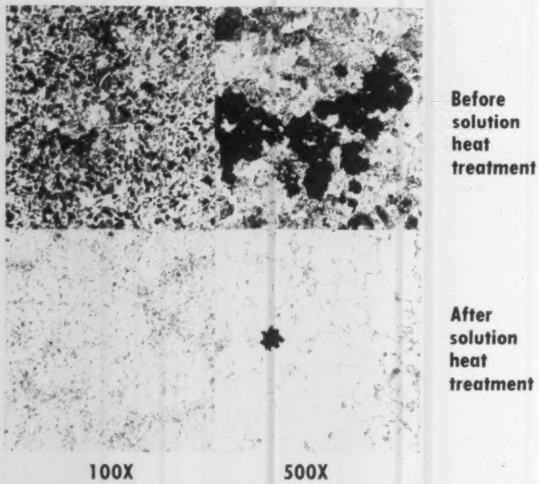


1 "MODERATELY" GRAPHITIZED weld joint can be rehabilitated by solution heat treatment. Process usually consists of heating graphitized area to about 1750 F to dissolve graphite particles

2 REHABILITATION of "severely" graphitized weld joint can be accomplished by flame gouging of heat affected zone. New weld metal is then deposited



3 "EXTREMELY SEVERELY" graphitized pipe section is replaced with new spool piece. Replacement is usually chromium-molybdenum alloy steel, which is not considered susceptible to graphite formation



SOMETIMES some graphite is retained after solution heat treatment. Although amount of graphite has been reduced from original "severe" degree, ductility is not fully restored

mately 30 to 50 percent of the pipe-to-pipe joints involving wrought materials. One specimen each should be removed from each joint involving a forged material on one or both sides of the weld joint. Also, at least two and preferably three weld probe samples should be removed from each joint adjacent to a cast material, such as a cast valve body.

The reasons for the larger number of samples desired for forged and cast steel materials is that forgings and, to a greater extent, castings are likely to exhibit greater variations in composition and metallurgical uniformity (grain size, etc.) than extruded pipe steels. In addition, cast steels as a general rule are likely to contain more carbon and aluminum than the corresponding grades of wrought and forged materials. In many steel foundries the 2 lb of aluminum per ton of steel addition needed for proper deoxidation is made in the runner box which, in rapidly solidified castings, may result in considerable variation in the deoxidation within the steel and corresponding variation in the susceptibility to graphitization. As a general rule, susceptibility to graphite formation in carbon and carbon-molybdenum steel increases as the greater amount of aluminum is added to the original melt for the purpose of deoxidation.

Variations in the degree of graphitization in carbon-molybdenum steel joints sampled at two or three locations as determined by metallographic tests are listed in Table 1. All joints contained at least some graphitization graded as "very mild," "mild," "moderate," "heavy," "severe," or "extremely severe."

TABLE 1 — VARIATIONS in degree of graphitization in carbon-molybdenum joints sampled at two or three locations as determined by metallographic tests listed. All joints contain at least some graphitization (very mild, mild, moderate, heavy, severe, extremely severe)

Structural component	Separation in grading					
	Same	1 deg	2 deg	3 deg	4 deg	5 deg
Wrought pipe, percent	50	30	17	3	0	0
Cast valve, percent	30	25	20	15	7	3

Degree of Rehabilitation Necessary Varies

Detection of the presence of graphite in its early stages in a weld joint may permit a rehabilitation program consisting of a special heat treatment only. When graphitization is detected in a more critical degree, a much more costly rehabilitation program may be required which may either consist of gouging out the respective weld and heat affected zones and rewelding, or may even require the complete replacement of the pipe, valve, or header materials in the piping system.

In carbon-molybdenum steel materials, joints with degrees of graphitization representing "mild" or "moderate" can generally be rehabilitated by a solution heat treatment. Such a solution heat treatment normally consists of heating the weld and heat-affected zone areas for 2 hr at about 1750 F. This should be followed by slow cooling to room temperature and a subsequent "metallurgical stabilization" heat treatment at 1300 F (± 25 F deg).

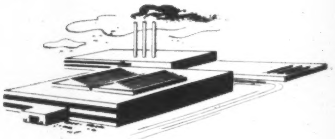
Since it is generally believed that solution heat treatments are effective only where the degree of graphitization is "mild" or "moderate," solution heat treatment should not be applied to joints having formed "heavy" or "severe" degrees of graphitization. There is considerable evidence that where the graphite particles were extremely large, the 2-hr solution heat treatment at 1750 F is not sufficient to cause complete solution of the graphite. Particle size therefore enters into the interpretation of the type of rehabilitation program considered most advisable.

An example of this is shown above, illustrating the presence of graphite in a severely graphitized carbon-molybdenum cast steel valve joint before and after solution heat treatment. Although the amount of graphite has been significantly reduced from the original "severe" degree, a few small graphite particles are still present after the solution heat treatment. In such cases, the ductility generally is not fully restored by the solution and metallurgical stabilization heat treatments.

Where solution heat treatments have been properly performed on joints for which these heat treatments have been recommended in accordance with the above considerations, no subsequent graphitization has been observed to date. This conclusion is limited to about six years of service experience in a large number of steam power plants. Yet, it indicates that a significant improvement can be obtained in piping systems by solution heat treatments and that the costly replacement of carbon-molybdenum steel piping is not necessary where a proper program of weld probe sampling is conducted throughout the power plant operation involving carbon steel at temperatures over 775 F and carbon-molybdenum steel at temperatures over 800 F. ╪

See Unlimited Market Potential For Big Building Air Conditioning

Industry will soar to new heights within the next 10 years



- **Industrial plants hold the biggest potential. Only 3 to 4 percent of the total plant area in the U.S. is air conditioned. The market that could be realized is $90 million annually — if we pry the lid from this segment of construction by driving home air conditioning's long-range economy to the user.**
- **Hospitals, the second biggest money maker, are riding the crest of a 40 percent increase in 1958 over the previous year. Patients demand air conditioning. And hospitals can't stay in business without patients.**
- **Commercial office buildings, the industry's top market based on dollar volume, have leveled at the all-time high set in 1956. Upwards of 300 million sq ft of all-air conditioned commercial office space will be built within five years. Large central plants will have tonnages surpassing any single system we have today.**

- **Stores and shopping centers will follow in the wake of the population boom and urban renewal campaign that will keep the cities and suburbs growing.**
- **Multiple family dwellings are being built at a rate of 150,000 units per year. By 1975 this figure can be expected to hit 300,000. Owners are being forced to add air conditioning to hold and attract tenants. The trend is toward central systems.**
- **Schools, currently fifth in sales volume, registered an increase in 1958 second only to hospitals. The majority of business is still for educational facilities at the college level. But in about 10 years all new schools will be air conditioned. This includes grammar and high schools, which represent the greatest potential within the market.**

- **The laboratories and research centers market since sputnik showed a 37 percent increase last year and will continue to make positive gains.**
- **The Federal Government's plans to air condition several hundred existing buildings, plus the many projects at state, county, and municipal levels, are indicative of the trend to air conditioning in public buildings.**

▶ ▶ ▶

AIR CONDITIONING:

"an infant at the threshold of a glorious future!"

BY CHARLES V. FENN
Vice President and General Manager
Machinery and Systems Div.
Carrier Corp.

THE AIR CONDITIONING industry is destined to move forward at an accelerated pace during the next decade, perhaps exceeding the total progress of the last half century.

More rapid strides will be possible because of advances already made in controls, new materials, and miniaturization through higher motor and compressor speeds and increased operating efficiencies. Development of new refrigerants and availability of nuclear power for commercial use will play big roles.

These scientific achievements will be essential to man's launching into—and habitation in—outer space. Their application for this purpose, as well as to his life underground, will dynamically illustrate the value of air conditioning to people everywhere, particularly those in industry.

Factory owners and managers will see more clearly the economic advantages to be gained through air conditioning in obtaining better quality goods. A greater number of them will realize that improvements in productivity and efficiency of workers are also favorably affected. Labor too, from steel mills to laundries and tailor shops, will recognize air conditioning as a means for pleasanter working conditions.

Industry's Potential Biggest

The nation's manufacturing spaces hold the greatest potential for large air conditioning. Volume of business that could now be realized annually from this market is $90 million. Further, if all production area in the U. S. worthy of air conditioning were so controlled, the overall total would reach $5 billion.

But this figure is *already* obsolete. In the time that this article has taken to be printed and mailed, factors such as population—which has increased 10 percent in the last five years—the missile race, and advancing living standards have created demands exceeding this estimate.

100 PERCENT outside air is conditioned and sent to each of five nurseries in this hospital. Hospitals are currently second largest source of air conditioning business

There are roughly 300,000 manufacturing establishments in the U. S., employing 15 million people. They have approximately 6.1 billion sq ft of space under roof. Just over 3 percent of this area is now air conditioned. Within the next 10 years, a minimum of 15 to 20 percent of all industrial plants will have air conditioned facilities.

Relief from the profit squeeze and demands for greater degrees of precision and quality will direct the attention of more manufacturers to such items as: (1) wastage of materials due to corrosion, damaging dust and dirt, and changes in temperature and humidity; (2) employee turnover rates and absenteeism; and (3) worker productivity.

The cost of factory air conditioning, due chiefly to uneven heat loads and problems involved with handling large open spaces, has deterred expansion of this field into becoming an explosive market. To overcome this, two truths must be driven home to industry:

1) The cost of air conditioning on a per ton or per square foot basis has not gone up in price anywhere nearly as rapidly as building costs and other related expenses. Where they have held level, in terms of inflation, this is really a decrease.

2) There is going to have to be more time spent analytically surveying potential jobs before more plant managers will agree factory air conditioning is economically practical. Instead of merely adding extra cooling capacity to solve vagaries of heat

CLEAN AIR is essential to many manufacturing and processing operations. Here, special exhaust ducts remove production fumes from transistor plant. Volume of business that could be realized in industrial air conditioning is $90 million annually

peculiar to plants, more engineering know-how will have to be applied. Systems that will pay for themselves in a few years and bring dividends in the form of increased profits continuing for the life of the equipment, can now be installed in factories.

We must pry the lid from this, the biggest market for the air conditioning industry. Based on square footage of factory area and the added uneven heat loads peculiar to industrial plants, air conditioning of factories for personnel and processing looms as the top money maker for this industry. It is today the industry's third largest revenue producer.

Manufacturers have found that employee efficiency has improved an average of 7 to 14 percent solely through the addition of air conditioning. One showed an increase of 37 percent in departments where a number of people worked fabricating small precision parts. Absenteeism dropped 30 percent and turnover of semi-skilled workers was reduced by 40 percent in another.

When it is considered that payrolls are over half the cost of doing business, the full magnitude of savings that are possible from controlled environment cannot continue to be overlooked. The focus is sharpened when factory owners also realize that only a 1.3 to 1.5 percent increase in worker efficiency is needed to pay the cost of a system.

Hospitals a Healthy Market

Currently, the second largest source of air conditioning business is hospitals. The population increase mentioned previously has helped to expand construction of hospitals tremendously in recent years. The history of this market has been a gradual but consistent increase in the number of systems installed in medical structures since the first application for a premature baby ward in Pittsburgh's Allegheny General Hospital in 1913.

During recessionary 1958, while most other markets either held their own or dipped slightly below previous established peaks, hospitals showed a great percentage improvement, advancing as much as 40 percent over the previous high set during 1957.

Aided by air conditioning, improvement of testing methods, and new therapeutic and post-operative care, average patient stay is now 6.7 days. This is a decrease of two-tenths of a day in one year and three full days less than the 9.7 days per patient averaged in 1951. It was 21 days in 1930. Hospitals are caring for more people, delivering more babies, giving more tests, and performing more operations now than at any previous time.

Air conditioning for hospitals is either installed at the time of construction or it is added to a wing or department according to a long range schedule. Virtually all priority administrators want completely air conditioned facilities. The order in which this is usually done, depending on available funds, is: (1) operating rooms; (2) delivery rooms; (3) patient areas; (4) laboratories; (5) public spaces; and (6) administrative offices.

An interesting sidelight pointing up patients' desire for air conditioning occurred recently in a North Carolina city. Three hospitals serve the community. After one of them was completely air conditioned, it acquired a waiting list for rooms while the others had vacant beds.

Hospitals in the foreseeable future will have cleaner, healthier air than we know it today. Instead of only in sealed areas, all air within hospitals will be sterilized from harmful bacteria. This development is being pursued for use in purifying air aboard space vehicles to avoid transmitting contaminants to other planets and satellites.

Offices Are Strong Leaders

Commercial office buildings, the industry's No. 1 market based on dollar volume, have hit a plateau since vaulting to an all-time high in 1956. This is temporary. Barring unforeseen circumstances, upwards of 300 million sq ft of new commercial space—all air conditioned—will be built within the next five years.

The General Services Administration plans to spend $328 million for air conditioning existing Federal office buildings under a seven-year program. Over the next five to 10 years the Department of Defense anticipates spending $700 million for air conditioning new and existing civilian and military facilities in connection with military preparedness.

Equipment to be developed for application in this market especially, however, is far more spectacular than the forecast for growth.

EXECUTIVE FLOOR at Guarantee Mutual Life Co.'s new home office, Omaha, has perimeter units furred into wood paneled walls beneath large windows

In the near future, large central plants with tonnages surpassing the 14,300 tons serving the Pentagon, world's largest single air conditioned building, will be much more common. They could well range between 20,000 to 50,000 tons. Centrifugal refrigerating machines with capacities of 4000 to 6000 tons per unit will provide the chilled water.

Powerhouses with such capacities could serve the major buildings in Chicago's Loop or New York's financial district. They could also provide chilled water for industrial complexes as well as entire towns in the same way as other utilities are metered to residences now.

We can look for outstanding new concepts in refrigeration equipment within the decade and further out. In the near future, the trend toward standardization of sizes from 100 tons to 4000 tons will become more pronounced. This will permit manufacturers to bring production costs down. Buyers and final users will benefit. And it will help make air conditioning more attractive to more people.

Abetting this trend will be new, more efficient refrigerants. They will permit compressors to attain higher speeds than, for example, the present 3600 rpm of large hermetic centrifugal compressors. Only a few years ago this was not thought possible.

The initial power source for driving refrigerating machines as well as all other air conditioning apparatus will be from atomic energy as soon as it is competitive with the fossil fuels—coal, oil, and gas. A nuclear reactor will not be supplied with each chiller, but electricity or steam produced from nuclear energy will be supplied by utility companies in much the same way as it is now.

Coincident with these advances, improvements in heat transfer will reduce the size of cooler and condenser shells. Overall space occupied by large capacity water chillers will be about one-third that of present day machines. Today's centrifugal refrigeration apparatus produces 35 to 50 times the capacity of early models, while taking up only half the space.

Systems To Shrink in Size

What about systems? Here too, consumption of space will be drastically reduced. This means air distribution velocities will be increased, sound levels controlled, and fan horsepowers kept low. Through design of fittings for taking air from the main header to cut resistance, today's velocities of 5000 fpm will be stepped up to 8000 fpm or even more.

Terminal outlets will be similarly smaller. Even in the last three years the size of air and water induction units has been greatly reduced. Inside of the next five to 10 years, cubage required could be halved, dropping space of in-the-room conditioning apparatus to a point where it is relatively insignificant.

All-air devices will shrink even further; a 75 percent reduction in physical size will be achieved. Lending a substantial hand toward making this goal possible will be controls for temperature, static pressure, velocity, and distribution. Great strides in regulating devices have already been made. Research and development work now underway can be expected to provide even better overall, absolute control.

Long range, modernization will come through integration or, in other words, installation of a wall or ceiling over the existing one with all service lines attached. The roots of this trend are in floor sections for new buildings constructed in this manner today and in combination air diffuser and lighting fixtures.

Availability of piping and air ducts integrated into sections forming outside curtain walls depends upon close cooperation between architects, consulting engineers, and manufacturers.

Stores Fourth Largest

The fourth most active air conditioning market in sales dollars has been department stores and shopping centers. Last year saw the first upturn in this business since the peak year of 1955 when industry sales hit $15 million. This trend should continue gradually. Major growth will remain in the suburbs, but don't count the downtown emporium out. Additional space will be added to the main stores and planned air conditioning programs will be carried to completion.

The population boom and urban renewal campaigns will keep both the cities and surburbs growing. Only one in every 13 American cities of over 50,000 population has shrunk in the past 10 years; all others have expanded or remained about the same. Futhermore, the big city core will always attract single people, newly married couples, professional people, and older folks.

Saturation of shopping centers in metropolitan areas, plus land costs, which have risen 80 percent during the 1950's, will slow the tempo of shopping center construction in the immediate future. As most centers are air conditioned when built, the decrease in new ones will be reflected in sales to this market.

Apartments Advance

The high cost of land, plus spiralling taxes and mounting service charges connected with private residential living, have stimulated apartment house building. These higher living costs will force more newlyweds —the greatest number the nation has ever seen—into rental housing, further bolstering apartment construction. A rise from 150,000 units built annually now can be expected to hit 300,000 by 1975.

Evidence of the rise in construction of multiple family dwellings was reflected this past year by a substantial increase in sales of central apparatus to this market. Many apartment owners have had sad experience with cheap air conditioning installations, spending more for maintenance service than the cost of a quality system. They are now leaning more and more toward central systems. A pattern similar to that established by commercial office buildings would also apply to apartments: when 18 to 20 percent of first class space in a city is air conditioned, owners of remaining non-air conditioned space are forced to add it to hold and attract tenants.

School Potential Staggering

A much larger market dollarwise, with even greater potential than apartments, is schools and universities. It is currently fifth in sales volume. During the past year improvement in sales to this market was second only to hospitals. The advance was more than 50 percent over the record set in 1955. And it is only beginning. The majority of business sold is still for educational facilities at the college level.

Despite progress made in this area, only 6 percent of classrooms at colleges and universities have been air conditioned. Gross potential in elementary and secondary schools is even more staggering. Less than 1 percent of some 1.2 million classrooms are now air conditioned and 159,000 rooms are still needed. If better than 10,000 classrooms were air conditioned annually, revenue to the air conditioning industry would total $28½ million. This figure applies only to instruction facilities. Dormitories, libraries, auditoriums, student union buildings, and cafeterias add to the attractiveness of this market.

Soaring enrollments in elementary and secondary schools require a 20 percent plant expansion by 1965. College facilities, already under pressure, must be almost doubled by 1970 to accommodate a steadily increasing flow of applicants. A record 3,250,000 students matriculated at colleges and universities this past fall. This number is 3.3 percent greater than the previous high chalked up the year before and the seventh consecutive one in which a new record was established.

To alleviate overcrowded conditions, compensate for teacher shortages, and speed up our educational processes so that we do not lose the global technology race, year 'round school programs are being tried. Double sessions have been started. Enrollment in summer schools is larger. Adult education programs and civic functions add to the number of hours schools are in use. These, plus better electric lighting, which emits a greater quantity of heat, combine to strengthen the need for air conditioning.

Air conditioning not only helps to muffle outside noises, provide even distribution of air to all parts of a room, and remove odors peculiar to schools, but it also helps teachers and students alike in the instructing and learning processes.

A substantial volume of air conditioning can be expected to be installed in existing schools. In virtually 10 years, all new schools will be air conditioned. This includes those from kindergarten through the 12th grade, which represents the greatest potential within the market.

They will be the hardest of all to sell because cost for air conditioning will be a part of bond issues, which must be approved by the voters. But publicizing air conditioning's benefits before these groups will help to further its application in homes and factories, in smaller cities, and even on farms.

Labs Move Up

Sixth largest category for air conditioning in dollar volume is laboratories and research centers. As evidence of emphasis on research and development since sputnik, this market registered a 37 percent increase last year. Previously, it showed steady advancement but never challenged or was among the leaders. Because of the importance of exact control for experimentation in research centers, interest exhibited in lab systems can be expected to be more than lip service. This market will continue to make positive gains.

Public Buildings Stir

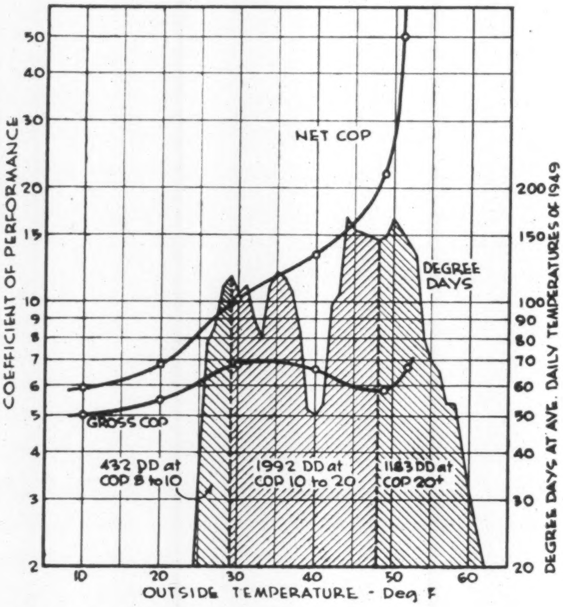
A three-year program has been launched by the Federal Government during which time it plans to air condition several hundred existing buildings, the bulk of which are post offices and courthouses. Most of the work started in mid-1958. Together with air conditioning projects at state, county, and municipal levels, which have been increasing in number, an important new category has opened up.

Expenditures by governmental bodies must pay dividends in the form of a return on investment. Federal authorities and a growing number of legislative members of smaller boards have found that "it is cheaper with air conditioning than without it." Buildings in this category being air conditioned include state capitols, city halls, police stations, jails, convention halls, civic centers, highway structures, and toll road restaurants.

The degree of saturation in all of the "most active" markets discussed, covering all major types of big buildings, is in most instances insignificant in comparison to the full potential before each of them. Air conditioning is very definitely a growth industry, still in its infancy. It is at the threshold of a glorious future! ‡

Don't Overlook The Heat Pump

. . . when prime need is cooling and good heat source is available



COEFFICIENTS of performance and degree days at average daily temperatures in 1949 charted here, as presented by J. Donald Kroeker at semi-annual meeting of ASHVE in Portland, Ore., in July 1951

• Operating performance data on four water source heat pumps show costs to be 2.2 cents per sq ft for heating, as compared with national average of 7.7. Cooling costs were 9.1 cents per sq ft as against average costs for air conditioned office space in the U.S. of 16.9 cents.

When the basic requirement is for cooling and when a low cost heat source is available, the heat pump is economically feasible, according to J. Donald Kroeker, consulting engineer, speaking at the recent symposium on heat pumps at the 65th annual meeting of the American Society of Heating and Air-Conditioning Engineers in Philadelphia.

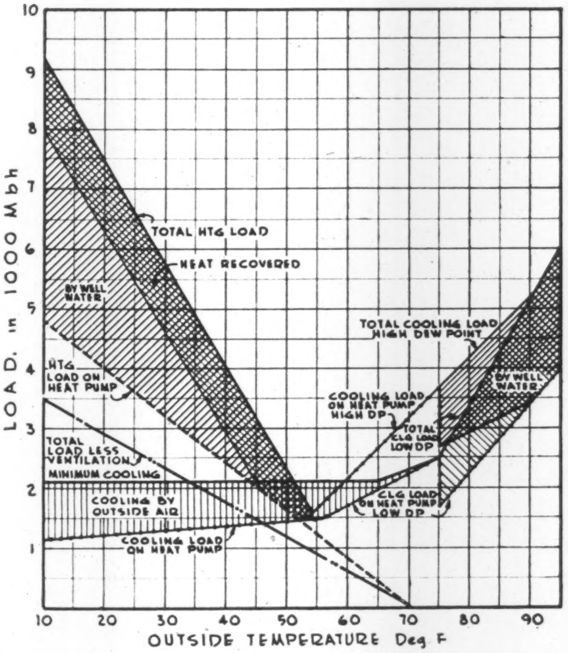
Mr. Kroeker cited operating experiences with four water source heat pumps in Oregon to show how heat pumps compared with other systems. On one of these installations, data on actual performance was included.

Outstanding examples of installations in which heating and ventilating — and, later, air conditioning — have been basic requirements are the powerhouses and numerous hydroelectric projects in the Pacific Northwest. Recently, the feasibility of heat pump systems in these powerhouses has been demonstrated. They are now generally employed for these applications, he said.

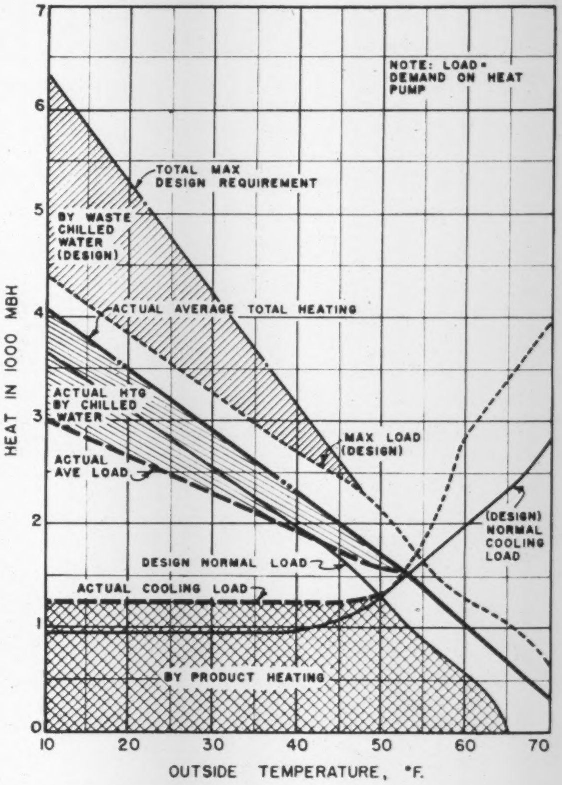
Prior to the installation of a heat pump system at the McNary hydroelectric project on the Columbia River, heating and ventilating had been achieved with electrical resistance elements. At McNary, it was conceived that the firm power sendout could be increased by about 3000 kw if a heat pump system were used, considering expected favorable performance factors. With power at an average of $17.50 per kw-yr, this meant some $52,500 was available annually to amortize additional first costs, he reported.

Other advantages became apparent. Rather than dissipate heat in mild weather and in summers by drifting large volumes of dust laden air through the building, the heat pump system made cooling available, permitting control of dust and reducing maintenance and repair costs measurably. Another favorable factor is a constant temperature heat source — the effluent cooling water from the generators — controlled to 74 F. This water is also used for preheating incoming ventilation air to 63 F from the design temperature of zero F.

Three centrifugal water chillers comprise the basic heat pump. These have a combined capacity of 590 equivalent tons of cooling. The predicted coefficient of performance of the heat pump only was 6.0 and of the heat pump and auxiliaries 4.5.



HEATING, COOLING load curves for Portland Oregonian building shown above were likewise presented at 1951 ASHVE semi-annual meeting by Mr. Kroeker



EQUITABLE LIFE Bldg.'s heating, cooling requirements shown here, as presented by Mr. Kroeker at 60th annual meeting of ASHVE in Houston in January 1954

Since much of the heating load is met by merely pumping turbine cooling water, the performance factor of the system as a whole is reportedly as high as 20. No detailed study has been made since the project has been put into operation to determine actual performance factors. Design analyses indicated a saving of $22,000 per year in energy costs chargeable to powerhouse heating with a heat pump system as against resistance heating, Mr. Kroeker reported.

Powerhouses of later hydro-electric projects on the Columbia River and its tributaries are being air conditioned and are similarly equipped with heat pump systems on the basis of analyses and experience with the system in the McNary dam installation.

Newspaper Plant Has Good Job

A heat pump system in the building of the Portland Oregonian was considered economically feasible because air conditioning would permit using space on each floor extending a full block; that is, without courts for ventilation. This provided unbroken lines of flow, extremely advantageous in a newspaper plant.

In 1947, when the building and system were designed, there was no completely air conditioned building in Oregon. So the concept was an innovation. Well water is the heat source and wells are used as heat sinks, with surplus water conveyed to a city sewer, stated Mr. Kroeker.

Features of the heat pump system include condenser-leaving water at design conditions of 135 F for use directly in ceiling and wall panels; no auxiliary heating is required; well water is used directly to recover heat from exhaust air and to precondition ventilation air; and, since it is a completely automatic installation, the cost of operating personnel is minimized.

Two nominally 275 ton open water chillers with wound rotor motors are used. One is a standby until the outside temperature drops to 25 F, according to design data. However, a single chiller has carried the entire load at 10 F, because internal heat loads, even though diversified, seem to be higher than normally estimated during design and because all the air conditioning units operate 24 hr per day, eliminating warmup loads contemplated in design, he said.

Minimum cooling, which provides heat as a byproduct, amounts to 2.1 million Btu per hr. Considering heating accomplished by well water and by recovered heat, there is no heat chargeable to heating above 45 F. At 10 F, the heat chargeable to heating is only 2.7 million Btu per hr, or about 30 percent of the total heat requirement.

Performance factors were predicted during design. The gross performance factor was taken as the relationship of the total heating load to the total energy required. This varied from 5 to 7. The net performance factor was taken as the total heating load, less the byproduct heating resulting from basic cooling requirements, divided by the total energy required. This ranges from 6 at 10 F to infinity at about 51 F, above which no energy purchased is chargeable against heating.

The installation of the heat pump system in the Oregonian was not instrumented adequately to permit determination of all quantities and temperatures required to compute precise energy uses and dispositions and costs of energy. In making several checks, it was found that the predicted data was very conservative, Mr. Kroeker reported.

Equip Engineers' Building

A relatively small heat pump system is in the Panorama Bldg., a 32 × 75 ft, two-story engineering office building in Portland. Air conditioning was a basic consideration. A heat pump system was provided, even though it appeared marginally economically feasible, he said.

The heat source is well water, wasted to a city sewer. Roof sprinkling to reduce the solar effect on the proportionally large expanse of roof and diversification of loads permitted application of a nominally 20 ton reciprocating water chiller. The system is an all-air application.

Performance factor curves have not been developed on this system. Operating costs for 1957 totaled $853.76, or 15.8 cents per sq ft. If an oil fired boiler had been provided to supply warm water, the cost of energy and fuel would have been at least $1015, based on 1957 degree days. So, even in this small building, the heat pump system resulted in a saving in operating costs of at least 16 percent, he stated.

Detail Equitable Bldg. Costs

The only larger heat pump system in the Pacific Northwest instrumented to enable precise studies of performance and operating costs was that in the Equitable Bldg., a 12-story rental office structure. It is 200 × 100 ft at the street level, 62 × 200 ft above the second floor, and has 212,000 sq ft of floor space of which 148,711 sq ft is rentable.

Alternately serving as heat source and heat sink are three wells, two at a depth of about 150 ft and one at 510 ft. The heat pumps consist of two 200 ton water chillers and two 70 ton air units. These all-air systems use the recovery of heat from exhaust air and the heat of ventilation air with waste chilled water, stated Mr. Kroeker.

TABLE 1—COMPARATIVE COSTS of energy for heating Portland's Equitable Bldg. using heat pump system and other methods listed here

Heating energy	Heating cost	Percent
Heat pump	$ 773	100
District steam	4930	638
No. 5 fuel oil	3430	444

TABLE 2—TOTAL COST of air conditioning Equitable Bldg. for 1 year, May 1, 1952 to April 30, 1953, tabulated below

Item	Heating	Cooling	Total
Heating energy	$ 773	—	$ 773
Cooling energy	—	$5702	5702
Fan energy	161	1961	2123
Operating personnel salaries	1790	5370	7160
Maintenance and repair	136	544	680
Water treatment	400	—	400
Total	$3261	$13,577	$16,839
Total/NRA (cents)	2.2	9.1	11.3

TABLE 3—COMPARATIVE ELECTRICAL COSTS of conditioning Equitable Bldg. at rates of other cities are as follows

City	Heating	Total	Percent
Portland	$ 773	$ 6,475	100
Seattle	1256	9,631	148
San Francisco	1481	10,343	160
St. Louis	1415	10,638	164
Chicago	1132	9,661	149
Minneapolis	1963	14,522	224

Derivation of costs of operation, segregated with regard to heating and cooling, of a heat pump system controlled automatically and providing heating and cooling simultaneously is complex and requires analysis and understanding of a large number of factors. These include: (1) the building; (2) use, as affecting first cost and operation; (3) the type of heat pump system; (4) basic differences between the heat pump and a conventional system, as affecting costs; and (5) heating and cooling load distribution.

Detailed studies were made for the period from May 1, 1952 to April 30, 1953. Continuous strip charts were analyzed half-hour by half-hour for the entire year.

Of particular interest are total costs of air conditioning with the heat pump system, comparative costs of operating the system and a conventional system, and comparative costs of energy at electrical rates of other cities. He pointed these out by showing Tables 1, 2, and 3.

Summarizing, the cost of energy chargeable to heating for the year was 2.2 cents per sq ft of net rentable area, as against a national average of 7.74 cents. Cooling costs were 9.1 cents per sq ft for energy, as against a U.S. average for air conditioned office space of 16.9 cents. Total operating costs, including labor and maintenance charges but not including annual depreciation charges, were 11.3 cents per sq ft of net rentable area, as against 27.3 cents, reported as the national average for all air conditioned buildings in the country.

Had district steam been used for heating for the year analyzed, the cost would have been 6.38 times that experienced. Fuel oil at 1953 prices, which have doubled, would have been 4.44 times the cost of power for the heat pump system, he said.

Compare to Other Cities

Since it had been contended that a heat pump system such as that in the Equitable Bldg. could be economically feasible only in the presence of extremely low electrical rates, such as were claimed to prevail in Portland, comparisons of costs of energy based on schedules in effect in other cities were also made. These ranged from 48 percent more in Seattle to 124 percent more in Minneapolis. District steam rates were approximately the same and oil prices were about the same or higher in these cities. Accordingly, in all cities listed, for the same building with the same heat pump system, the savings in energy costs would have been high enough to justify like installations. ‡

tricks, traps, and trends

LESTER T. AVERY, author of this new feature, is president of Avery Engineering Co., Cleveland mechanical contractor, and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors. On this page, to appear regularly, he will reflect on his installation experiences.

Mistakes of the 20's Are Still Being Made

AIR CONDITIONING has come a long way since the early 1920's. From the old carbon dioxide compressors of that day have evolved new design techniques, new equipment, new refrigerants. With each refrigerant development, changes have been made in compressors, auxiliaries, and controls.

Some of the mistakes we made in the 20's are still being made today. One particular problem is the very real one of freeze-ups.

I'll go back to one of my first experiences in water chilling in those early days, when Otto Labus, then chief engineer of American Carbonic Machinery Co., was asked by Armin Tashjian, mechanical engineer with Walker & Weeks, architects, "What will happen if this automatic control doesn't work and the machine keeps on running?"

The reference was to the first use of thermostatic controls for starting and stopping compressors used on enclosed type water chillers. Until that time, water cooling had been done in open tanks with submerged coils. A little ice didn't matter. The question here was: How could you chance freezing ice in an enclosed pressure type tank?

I well remember Otto's reply. He said that if the control didn't work, the machine was still a freezing machine and would keep on freezing, but that the control system was being bought to work and should be expected to work.

Here we are, 35 years later, putting in water chilling systems and still having the problem of freeze-ups. In fact, some of the problems now seem to be more difficult to handle than those in the 20's because now we're chilling water at 45 F or lower for air conditioning.

On one recent job, which consisted of a duplex 40 ton compressor arrangement with two separate circuits, and a common water chiller (making a total of 80 tons), we had a freeze-up which had disastrous consequences. The ice got between the tubes and tube sheet, sprung a dozen or more tubes away from the tube sheet, caused all the refrigerant to be lost, permitted water to get into the compressors, and cost thousands of dollars to repair.

When we checked into the operating conditions to find why this particular chiller froze, we discovered that, in order to keep the compressor running on the light load conditions which existed at the initial startup in the spring, it was necessary to set the suction pressure cutout below freezing temperature. An antifreeze thermostat was supposed to protect the chiller from freezing and the compressor was arranged with a single step pumpdown to reduce slugging on startup.

If there is such thing as original sin in the air conditioning business it is the running of a refrigerating machine below freezing temperature when you're working on water which wants to freeze at 32 F. Who says the flow of water through the chiller is uniform? Who says that a freezing condition around the tubes at the tube sheet will be reflected at the nonfreeze thermostat? The answer, in each case, is "nobody."

And that's what happened. The chiller froze up when delivering 45 F water. Actually, it froze every time it shutoff on the thermostat. In other words, whenever the thermostat caused this particular machine to pump down and stop, ice formed between the tube and tube sheet. After about three months this finally pushed the tube away from the tube sheet and the fat was in the fire—or better, the water was in the refrigerant.

The trap in this case—if it were a single trap—was that the chilling surface was too small for the compressor capacity and the desired water temperatures. How to correct it? The compressors were slowed down, new expansion valves of the right size were installed, the suction pressure cut-out was set at 32 F, and the water temperature control was raised so that everything was *off* at 45 F and everything was *on* at 50 F. The thermostatic control was put on the water outlet from the chiller.

Here are some rules: Keep suction pressure above freezing or else use a nonfreeze solution. When you come to buy equipment, try to get enough surface to match up with the compressor. Here again, you might note that the manufacturers are very much inclined to *under-rate* compressor capacity to make up for possible deterioration of valves, pistons, etc., and the manufacturers of heat exchange surface are inclined to *over-rate*, taking advantage of temperature difference gradients and water circulating volumes to get more rating out of less surface.

There is no substitute for knowing how many square feet of surface and what it is supposed to do in relationship to the compressor capacity at the operating temperature. ✢

DEDICATED only last August, Los Angeles County's central heating and air conditioning plant serves 10 county buildings via complex, octopus-like piping and duct system. Structure contains 36,000 sq ft of floor space, is equivalent to six-story building in height

Multiple Piping and Duct System Heats, Cools 10-Building Civic Center

. . . from new $4.5 million central plant. Designed to make most efficient year 'round use of steam, system comprises five gas-oil fired boilers for heating and supplying four steam turbine driven centrifugal compressors which can provide 4400 tons of cooling. Distribution piping and ducts are ceiling-hung throughout 1500 ft of tunnels connecting buildings to central plant.

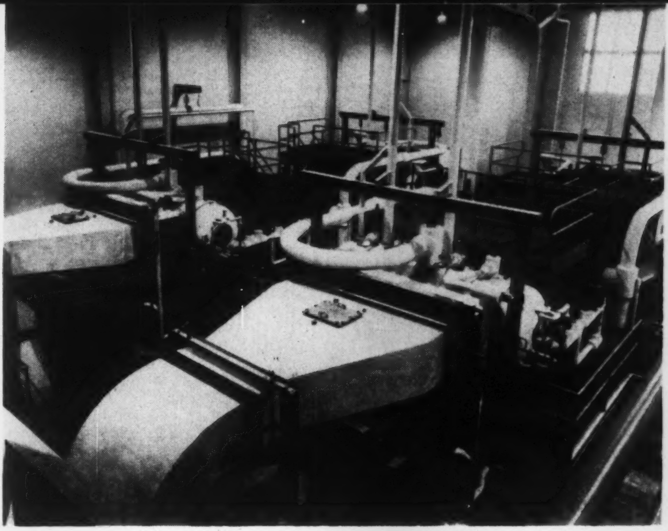
FOUR steam turbine driven centrifugal compressors serve 10 Civic Center buildings from Los Angeles County's new $4.5 million central heating and air conditioning plant—believed to be the biggest, most complex of its kind.

The plant rises from Los Angeles' Civic Center, and distributes to the 10 buildings through ¼ mile of utility tunnels—the largest multiple building piping and duct system west of the Mississippi. From the central plant, 1500 ft of reinforced concrete utility tunnels link the buildings.

Ranging in depth from 15 to 20 ft underground, the tunnels have a dual purpose: They not only distribute the central plant's steam and chilled water, but also serve as pedestrian walkways. Also, they carry some electrical service and telephone lines. Tunnel distributed are chilled water for cooling (45 F supply and 55 F return), 275 psi steam for heating, and softened cold water.

Five combination gas-oil fired boilers supply a total of 120,000 lb of steam per hr. Steam both heats the 10 buildings and drives the central plant's refrigeration compressors (and some auxiliary equipment), achieving a uniquely balanced summer-winter heat load. Four steam turbine driven centrifugal compressors have a refrigerating capacity of 4400 tons. Only six operators per shift are needed to man the plant.

It is estimated that centralization



MAIN BOILER ROOM contains five steam boilers with auxiliary equipment to produce 24,000 lb of steam per hr each at 275 psi. Boilers are equipped with combination gas-oil burners

will, over a 20 year period, slash about $2,972,000 from county heating costs and some $1,603,000 from air conditioning expenses. Total savings—about $4.5 million—equal the construction costs of the central plant and its service tunnels.

Served are the Hall of Justice (and its annex), Hall of Records, County law library, new County courthouse, plus five structures planned to rise from the Civic Center, including a new Hall of Records, administration building and garage. Prior to the completion of the new plant, none of the buildings was air conditioned, though several (their construction dating back several decades) had independent heating systems, which have been removed or disconnected.

The plant, of reinforced concrete, is about 180 × 240 ft and rises the equivalent of six stories above its lowest level and is topped by a cooling tower concealed by a vertically louvered wall. The building is windowless, except for a decorative entrance. Horizontal aluminum louvers run the structure's length, providing natural ventilation.

Design for Heat Load Balance

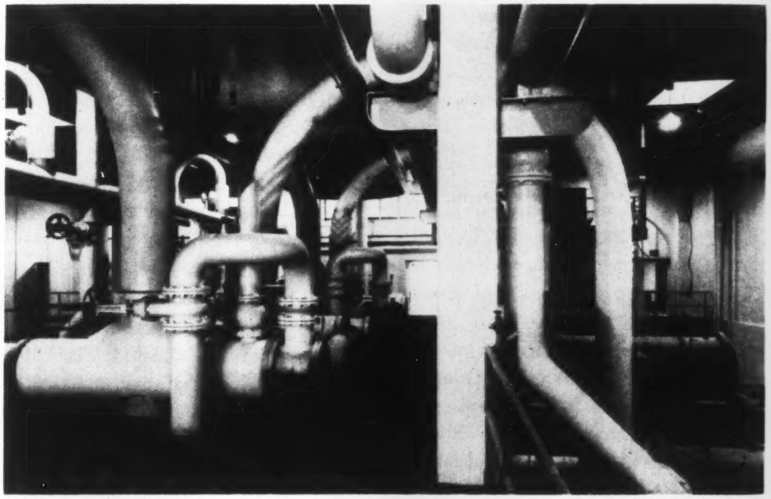
Inside, 16,000 sq ft is devoted to the central steam plant, its five water tube, two drum water-wall steam generators, each capable of continuously generating 24,000 lb of steam per hr at 150 percent rating, and able to produce 32,000 lb at 200 percent for periods up to five hours (with feedwater at 200 F).

The consulting engineer retained by Los Angeles County to design the system developed an interesting heat load balance. His study showed that, regardless of heating load, steam utilization should be sufficient to allow boilers to operate efficiently the year 'round.

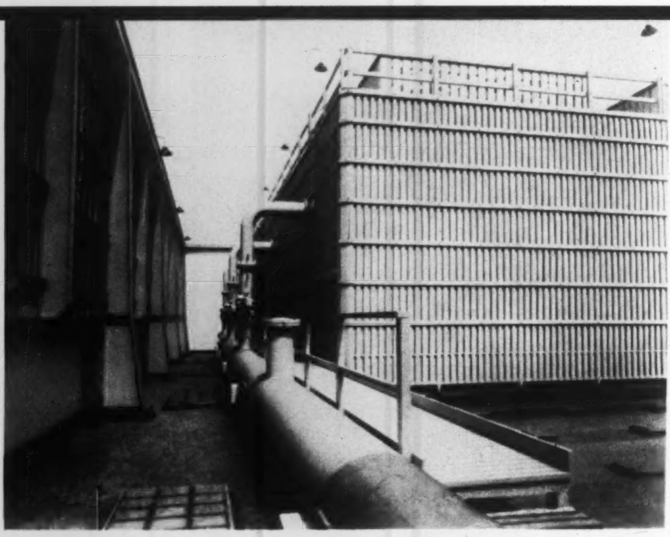
Putting this to practice, four steam turbine driven, centrifugal refrigeration compressors provide chilled water for air conditioning. This not only assures a sizable summer load for the boiler plant, but allows year 'round efficient operation.

To make the most use of otherwise waste heat, two boilers are provided with dual fan drives, steam turbine as well as electric motor. Additionally, one of three boilerfeed pumps (rated 125 gpm at 850 ft head), a fuel oil preheater, and a 28 gpm fuel oil pump are also steam turbine driven.

Above the main boiler room floor is a soundproof, air conditioned, glass enclosed control room which is flanked one side by a boiler control panel and on the other by a refrigeration control board. From here, a single operator monitors: (1) boiler room gages and meters; (2) refrigeration compressor operation; and (3) such associated services as domestic cold water softening.



STEAM IS CONDENSED after it passes through steam turbines driving refrigeration machines. Steam condensers operate at below atmospheric pressure in order to produce more economical plant operation. Steam condensed in these units is pumped back into feedwater system of boilers



CONDENSER WATER at 85 F pumped from underground reservoir goes through refrigeration equipment where it is raised to 105 F and, in turn, up to this cooling tower on roof where it circulates before falling back to reservoir at 85 F

4400 Ton Cooling Capacity

Another 8000 sq ft of space is occupied by the four steam turbine driven, refrigerant No. 11, centrifugal compressor units. Two are rated at 1300 tons, and two at 900 tons. The use of plant steam assures a heat balanced load, winter or summer.

Underground and outside the plant lies a two-sectional concrete cooling water basin which is 35 × 40 ft and 7½ ft deep. It is sectionalized so that one section can be shut down for cleaning, without interrupting the service.

Drawing from this basin are four vertical turbine pumps. Two of the units are 200 hp, delivering 3890 gpm at 130 ft head. The other two are 150 hp, delivering 2700 gpm at the same head.

They circulate water from the basin through the condensers, then over the cooling tower and back to the basin. The tower, mounted on the roof, can handle 10,800 gpm. Maximum inlet water temperature is 105 F, while the outlet temperature is about 85 F.

In-plant steam, after driving the four compressor turbines, is routed into the condensers via a 20 in. pipeline, and the condensate is returned to the boiler plant. For each ton of cooling, 13 lb of steam is required.

Four chilled water pumps are all working at a head of 130 ft. Two are rated at 150 hp and 3110 gpm, and two are rated at 100 hp and 2160 gpm. These pumps circulate chilled water from a 2800 gal surge tank, through chillers, and into the 20 in. steel piping system to the buildings.

Compressors are manually started or stopped on signal from high or low temperature alarms. However, once compressors are started, they are automatically controlled over their specific range by a master recording controller actuated by the system's leaving chilled water temperature. The controller, by means of a pneumatic signal, positions the turbine throttle valve (and each machine's hot gas bypass) to achieve preset leaving temperatures.

Pumps, circulating chilled water through the system, are manually put on and taken off the line. The number of pumps needed is indicated by a combination pressure-flow recorder mounted on the constant pressure bypass. When system pressure falls below set pressure, an alarm sounds, indicating need for an additional pump on the line.

Provide Master Control Panel

The pressure-flow recorder, like all other plant metering devices, is located on the master control panel in the control room.

Among the centralized control devices are chilled water distribution and Btu meters, including a pressure and flow recorder from the chilled water distribution header, and electronic resistance temperature recorders on the chilled water supply and return headers. Also included are recorders for high pressure steam to the turbines and a chilled water temperature recorder-controller.

Refrigeration units are supplied with two types of chemical feeds: (1) concentrated sulfuric acid (from a 5000 gal underground tank) which automatically maintains preset pH levels in the circulating water basin (via a 1½ gpm chemical pump); (2) sodium hypochlorite which is "shock fed" by a timer every 24 hr to the cooling tower (maintaining 2 ppm chlorine for algae control).

7 Main Distribution Lines

About 1500 ft of underground distribution tunnels serve the nine buildings. Supported on ceiling hung structural steel beams or expansion rollers are seven distribution lines:

1) Two 20 in. chilled water supply and return lines (steel) for air conditioning. The supply carries 45 F water; the return water is about 55 F.

2) Two 8 in. steel steam lines, supply and return, which carry steam at 275 psi for building heating.

3) A 4 in. copper cold water line, distributing softened domestic water.

4) A 4 in. pump condensate return line operating at 180 F.

5) A 2 in. high pressure line for returning condensate to the plant's deaerating feedwater heaters.

The plant was designed by M. A. Nishkian & Co., consulting engineers. Scott Co. of Southern California was the mechanical (heating, piping, and air conditioning) contractor. ╪

What to Do About Noise, Vibration In Water Piping Systems

Vibrations in water piping systems originate at one of two places: within the fluid, or in some solid (structural) part of the system, stated Professor W. L. Rogers of the mechanical engineering department, Northwestern University, at the symposium on hydronics at the 65th annual meeting of the American Society of Heating and Air-Conditioning Engineers in Philadelphia. He cited such examples of fluid noise sources as fluid pressure pulsations from pumps, from flow through piping components, and from water hammer. Structural vibration sources include unbalanced rotors in pumps and motors, frictional forces, electrically induced mechanical forces, and loose parts in the system.

It is well known that the vibration produced in the fluid does not remain entirely in the fluid, and that the vibration produced in the structure does not remain in the structural parts of the system alone. There is interaction, and a pressure oscillation in the fluid can cause excessive lateral pipe vibration under certain circumstances. The interaction is much stronger for water-filled pipes than for gas or vapor-filled pipes, an important factor being the relative compressibilities of the fluid medium and the material of the pipe. The pipe dimensions are of importance also, for they influence the "stiffness" presented by the pipe wall to the pressure variations in the fluid, he said.

A self-excited or self-sustained type of oscillation can be encountered in certain types of valves. The essence of this type of oscillation is that the vibrational motion itself includes actions which tend to sustain the vibration. For small amplitudes, energy is fed into the vibrational motion to increase it; while for much larger amplitudes, energy is removed so that the vibration is decreased, according to Professor Rogers.

The oscillations or collapse of gas or vapor bubbles in the liquid of the system can be potent sources of noise. Bubble oscillations are produced as a bubble and are carried by the stream through a region of varying pressure. The varying pressure on the bubble constitutes forced oscillation of the bubble, but the natural frequencies of oscillation of the bubble are excited as well. It is possible that flow noises produced from other causes, such as pumps, can be intensified *or* damped by the presence of bubbles, depending upon the forcing and natural frequencies. And, of course, the noise of cavitation requires the presence of cavities in the liquid. A common experience is the elimination of hissing noises resulting from elimination of trapped gas, he said.

In experimental work, it has been found that sudden enlargement of a flow passage into a low pressure region results in particularly intense noise generation within the flowing water. Flows through orifices or through partially closed valves are examples.

Effectiveness of Rubber Hose Varies

The effectiveness of rubber hose in reducing transmitted vibrations varies with its stiffness and length, as well as with the frequencies present. Soft hose is better than stiff hose, and high frequencies are more effectively damped than low frequencies. Reliable and complete quantitative information is not available, but the length of commercially available hose required for worthwhile sound reduction is practical in many instances, amounting to a matter of no more than a few feet. Both fluid-borne and structural-borne vibrations can be reduced, usually by different amounts, he reported.

Hose reduces fluid-borne sound probably by a combination of pressure relief and internal damping (dissipation) in the rubber as it vibrates with the pulsing fluid. The latter action is very evident as one touches the surface of soft rubber hose or listens with a stethescope to the rapidly diminishing sound as one moves downstream.

Hose impedes transmission of structural vibration by introducing flexibility in the structural path, he pointed out.

A sudden enlargement in a pipeline acts as a low-pass, high-frequency cutoff filter for fluid-borne vibrations. Only a limited amount of design information is available at present for such water filters. The larger the enlargement, the lower the frequency above which frequencies are cut off.

In general, to stop transmission of noise in liquid piping systems, it is necessary to insert a "block" in the path of transmission. The block can *reflect* the vibration, damp it by dissipation, or *counteract* it. It has its counterpart in the well-known dynamic vibration "absorber." The method of application of the idea to piping systems needs further study, he said.

Many Opportunities for Noise Problems to Occur

A piping system inherently contains a multitude of opportunities for resonance with source disturbances. In the fluid path are organ pipe effects, and in the structural path are vibrations of pipes, components, and the masses to which they are attached, stated Professor Rogers.

A vibrating surface which is radiating sound produces *more* sound, of course, as it vibrates at greater amplitude. It has been amply demonstrated that greatly increased lateral vibration of a piping span can be produced if the lateral natural frequency of the span coincides with the frequency of either fluid or structural vibration sources. This in itself might not produce a comparably greater sound, particularly for small pipes. It is to be noted that it is *not* the vibration of the air caused directly by vibration of the *string* of a piano which is responsible for the loud sound. It is the vibration of the much larger surface of the sounding board which is primarily to blame. It is true, of course, that the vibration of the string *causes* the sounding board to vibrate, and that larger string vibrations cause larger sounding board vibrations. The analogy to pipes (as "strings") connected to building panels (as sounding boards) is obvious. The types of pipe supports and the characteristics of the panels obviously affect the elasticity of the system and hence the natural frequencies.

Presumably the fluid organ-pipe resonance effects in a system can cause magnification of the amplitude of the pressure variations of fluid sources such as pumps. Thus, excitation could be increased for vibration of pipes and their attached panels, and a noise problem might become significant which might have been negligible without the fluid resonance effect. Simple organ-pipe resonant frequencies for liquids (and gases) can be calculated, and have been checked reasonably well in experiments with water in pipes open at one end and closed at the other, Professor Rogers reported.

How Can Noise Be Minimized?

General considerations in minimizing noise must include reducing the *source* amplitudes; avoiding amplification by resonance; and minimizing transmission by means of filters or reflectors, damping by dissipation, or counteracting devices, he stated.

Low noise pumps must have properly designed flow passages, must be balanced, and must be operated by balanced electric motors. In addition, soft isolation mountings are commonly used to block structural transmission. A low noise system also requires use of reasonable flow velocities. No absolute rule can be given here. In general, tests have indicated that the components (elbows, valves, etc.) of a piping system are more likely to be offending noise makers than the pipe itself. Thus, a higher velocity could be used in a system of fewer components and section changes.

Throttling action through obstructions such as valves and orifices is particularly offensive, especially on the downstream side. Such information is important when designing flow passages in pumps for quiet operation. It appears, in general, that gradual pressure drops are preferable to sudden ones, he said.

Avoiding amplification by resonance obviously requires consideration of forcing frequencies and natural frequencies. Motor and pump speeds and the number of pump impellers determine significant pump frequencies. Type of piping components and velocity through it determine frequencies of this flow source of noise. The presence of bubbles also is of importance. The pertinent *natural* frequencies might be controlled by altering motor, pump, and pipe mounting stiffnesses; lengths of piping spans; lengths affecting organ-pipe resonances; by elimination of random bubble sizes; and probably by adjustment of the vibrating *masses*, where feasible.

Transmission can be reduced by using proper rubber hose inserts which can block *both* fluid-borne and solid-borne vibration when properly arranged. While offering increased flexibility and therefore seemingly greater damping action, hose inserts also introduce hazards of new natural frequencies, and, when curved, they can impart structural vibration to the attached pipe when fluid pressure fluctuates at the bend. Hoses also have obvious limitations, he pointed out.

Sudden enlargements act as low-pass filters, stopping transmission along the liquid path of frequencies above a value which is affected by the size of the enlargement. More design detail for water filled systems is needed. Other types of filters are possible, too, including high-pass and band-pass. These have had only cursory attention as related to water piping systems.

Damping devices can be constructed which divide the flow among many small tubes, preferably with laminar flow in each. The increased solid surface in contact with the flowing fluid results in increased dissipation due to fluid shear, and hence more resistance to fluid fluctuations.

Counteracting devices for fluid vibrations would embody the idea of applying a pressure "trough" to the location where otherwise a "peak" would exist. In the mechanical parts of the system, a "push" would be supplied to counteract a "pull." In each case, a local position of essentially zero variation (a local node) would be enforced. As an example, a dynamic absorber effect could be obtained by control of gas bubble size, or, more practically, by the use of equivalent elastic elements in the system, concluded Professor Rogers. ⧧

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Must Allow for Sun Heat Effect When Planning a Building

ARCHITECTS seem to do their best "to frustrate" heating and air conditioning engineers in too many instances, commented Edwin Daisley Thatcher (an architect himself) in the discussion following presentation of his paper on heating by hypocaust at the ASHAE's annual meeting.

There should be more liaison between the architects and the engineers in the early stages of planning a building; for example, the importance of sun heat in both heating and cooling should be realized and allowed for, he said. Large glass areas on the west face of a building are "brutal" insofar as the air conditioning system is concerned, he commented.

Mr. Thatcher's paper on hypocaust heating had seemed to many, from its title, to be of only historical significance but proved to be of considerable practical interest as well, judging by the discussion and comments following his presentation.

Mr. Thatcher first became "involved" in his subject some years ago when he designed a slab-on-ground structure in which warm air was circulated through the floor construction for heating. His interest in the method led to his extensive studies of the hypocaust system used by the Romans for the Forum Baths at the ancient port of Ostia, near Rome.

His research indicated that the hypocaust was an efficient and successful method of heating, and that through its use and the orientation of buildings to take advantage of heat from the sun, radiant heat made conditions comfortable for bathers even though there were large unglazed window openings.

An engineer in the audience who is concerned with the tobacco industry found the hypocaust paper of particular interest because of the possible application of the ideas to buildings for curing tobacco.

Others seemed impressed by the knowledge the early Romans had — and used — of how to orient their buildings to make use of sun heat and how to protect the rooms that required higher indoor temperatures from prevailing wintertime winds.

Will Heat Gain From Lights Offset Shading?

IN A DISCUSSION following presentation of a paper on heat gain through windows shaded by metal awnings, by Necati Ozisik and L. F. Schutrum (both of the ASHAE research laboratory staff) at the ASHAE annual meeting, it was suggested that movable shades are often desirable for reducing solar heat gain as they do not also reduce light. Heat gain from room lights with some forms of shading may be greater than the solar heat excluded, it was stated.

In reply, Mr. Ozisik said that consideration was being given this question by the technical committee sponsoring this research study.

Unofficial Definition Of Comfort

"COMFORT is the condition the majority of people would prefer if they did not have to pay for the result — and did not know a test was in progress," said Charles S. Leopold, consulting engineer, commenting informally at a session on the right air conditions for human comfort during the ASHAE annual meeting.

Discuss Aluminum Fin, Copper Tube Coil Applications

A MISUNDERSTANDING developed during part of the discussion following the symposium on corrosion and water treatment at the ASHAE annual meeting — but it was cleared up after several comments from the floor and from members of the panel. In his presentation, one of the panel members had warned against the use of dissimilar metals — such as aluminum and copper — in a piping system as a potential source of galvanic corrosion. An engineer in the audience noted that he had seen air conditioning coils made of aluminum fins and copper tube on display at the exposition, and wondered if this construction might lead to such corrosion problems.

In the somewhat spirited remarks made in answer to his inquiry, it was explained that the earlier reference to corrosion applied only to a combination of dissimilar metals in a piping system in which an electrolyte — such as impure water — was flowing. No such difficulty could possibly be expected with aluminum fin and copper tube air conditioning coils, except — it was stated — in the case of a sprayed dehumidification coil over which recirculated water was sprayed.

The chief engineer of one of the coil manufacturers said that his company recommended use of copper fins on such sprayed coil jobs. However, a consulting engineer reported that he had used coils of copper tube and aluminum fins, with the aluminum completely covering the copper, on sprayed coil installations and had had no trouble whatsoever, even with the water being recirculated and thus containing dissolved impurities. A contractor also reported no troubles of any kind on such installations.

While the point under discussion came to no "formal" conclusion, the consensus seemed to be that there is little possibility of such corrosion problems with aluminum fin-copper tube combinations, except perhaps very occasionally with sprayed coil installations.

Winning the Air Conditioning

Round 3:

Know Your Enemy

BY ALBERT B. HUBBARD

ODORS will play practical jokes on an unwary odor investigator. A sleuth, after sniffing "dirty feet" odor in an air conditioned office, became embarrassed. He couldn't tactfully hunt the source. Meanwhile, ink and lubricant odor, harmless when sniffed at the office's business machines, was being transmuted into the stench by dilution.

● Rounds 1 and 2 (January and February) in this series have discussed the ability of the nose to detect odors both qualitatively and quantitatively. But what about the odors themselves? What are their physical properties? Actually, everyday common odors are usually complex blends of several odorants with different physical characteristics and different thresholds. How these compounds react when they are separated into their sources is discussed here. The author also debunks some popular misconceptions pertaining to odors.

Mr. Hubbard had a long association with General Electric Co.'s air conditioning department and has had considerable experience in the design and installation of air conditioning systems. For several years he was a member of the American Society of Heating & Air Conditioning Engineers Technical Advisory Committee on Odors and its chairman during 1956 and 1957.

This happening is but one of the tricks rooted in the physical properties of odors.

In my first two articles in the January and February issues, the mechanics and calibration of the nose were discussed. Now the odors themselves will be taken up.

Most common odors are actually complex mixtures of odorants. Each component has different physical properties and, quite likely, different thresholds. These differences will separate familiar blends into fractions which are unfamiliar. An investigator soon learns that, almost by definition, unfamiliar blends are unpleasant. People usually view a strange odor with suspicion, fearfully wondering at its source.

The practical result of separation is that odor sources are often hard to track down.

Differing thresholds means that as a blend is diluted the components may drop out, one by one, the weaker odors disappearing first, as occurred in the ink-lubricant blend mentioned.

A well-known separation, caused by differences in volatilities, occurs in cheap "dime store" perfume. The first nasal impression is good. Then some components with high volatilities disappear quickly and you become aware of vanillin and other unromantic smells.

Every surface has some ability to absorb odors. This ability varies with the kind of surface. A given surface may adsorb some components of a blend strongly, others negligibly, and still others in all degrees between. The same is also substantially true of absorption. The morning-after-the-party smell is an example of absorption separation. While the party is in full swing, the drapes

Odor Fight

and other cotton fabrics are busily picking up the typically "tobacco" part of tobacco smoke. But the cotton prefers water vapor. Therefore, as humidity comes up in the latter part of the night, because of diurnal temperature cycle or because of turning off the air conditioner, cotton trades back the worst part of tobacco odor for vapor. Next morning, the room is filled with stale tobacco smell.

Another separation occurs when food odors pass through an air conditioner's wet cooling coil. Pleasant food aromas, inhaled by the conditioner's indoor grille, are exhaled as "garbage pail." Perhaps part of the blend is scrubbed out by the wet coil surfaces or perhaps the cool damp discharge merely supplies a vivid garbage association. At any rate, never aim the discharge directly at a restaurant's customers.

"It's the Air Conditioner's Fault"

A spectacular adsorption separation is responsible for *coil odor*[1]. An unusual and unfortunate combination of circumstances produces this one. The material of the coil surface must strongly adsorb the more unacceptable components and tend to retain them. The load must be steady, with little chance for the coil to desorb during off cycles. When the coil deposit builds up, the owner and his clients smell an indescribable stench that is easily traced to the air conditioner. The playback of the coil odor may be briefly noticeable at morning startup, but it usually becomes unbearable in late summer when sustained hot weather suddenly moderates.

To check an air conditioner for coil odor during the winter, merely start the fan and sniff the air at the discharge. Because the adsorbed odors have remarkably low volatility, they will remain almost indefinitely in still air around the coil. Rated air flow, with the coil at room temperature, will desorb a coil deposit in a week or so.

Coil surfaces can adsorb odors below threshold concentration. A coil can build up a component which was seemingly not present, then suddenly play it back to cause real mystification. The owner can rightfully complain, "We never noticed any odors around here before. It's the air conditioner's fault."

Let's Correct Some Fallacies

Speaking of coil odors, a fallacy must be noted. Most engineers jump to an incorrect conclusion. They postulate a slimy deposit on the coil surface and bacterial action. I, for one, fell into this trap and armed myself with specimen bottles and swabs when I first went into the field. I succeeded in getting faint green marks on my swabs; but nothing to analyze. It became painfully clear that such deposits generally do not exist. Some of the cleanest looking surfaces smelled the worst and vice versa.

While on the subject of fallacies, another is that the filters are the focal point. I have smelled hundreds and found nothing but a dusty odor. One lone exception was the case where pushcart peddlers burned refuse in a gutter near a store. Some of the filters had a faint burnt odor.

Let's dispose of still another false theory. We can reason that an odorless substance may react chemically with a relatively odorless vapor to make a new compound with a powerfully foul odor. We may even postulate a catalyst, perhaps the coil surface or the dust on a filter. Competent chemists scoff at such reactions at these low concentrations and temperatures.

Back to physical phenomena again, how are odors maintained in an air conditioned space? The tendency is to regard only the air volume as infected. Instead, picture a source feeding odor into the air volume and a sink taking odor out. Concentration in the room air is a resultant of the speed at which the odorant is supplied and the speed at which it leaves.

Let's go back to smoking as an example because it illustrates several mechanisms. Smoke a cigarette in a tightly closed room. Odor builds up to a maximum which depends on the room's size. As the odorous vapors are adsorbed by walls and furnishings and tarry droplets are deposited, the odor seems to die away. Then stale tobacco is smelled as the droplets evaporate. The staleness comes in waves as temperature-humidity cycles disturb the adsorbed components. The one cigarette in a closed room becomes an almost permanent odor source. It is easy to see that, as the experiment is repeated with increasing rates of ventilation, odor peaks decrease during smoking and after effects are less prolonged. At some high rate of air change, no after smell is apparent. However, if we now reseal the room, a stale tobacco odor might return.

In odor work, never blame things on the "little people." A little knowledge of the physical properties of odors and a lot of common sense will produce a logical explanation of odor situations every time.

Next month Round 4 will discuss summer odors and show that the air conditioning odor fight is really a battle royal. ‡

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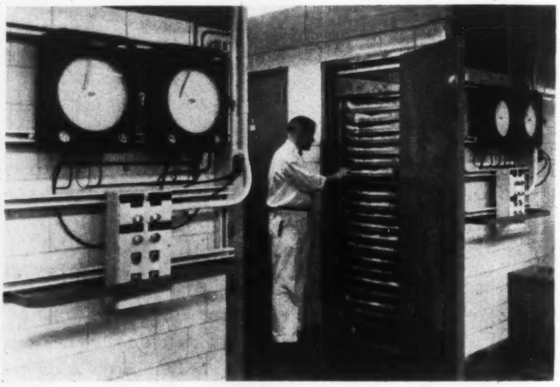
[1] *Air Conditioning Coil Odors*, by A. B. Hubbard, N. Deininger, and F. Sullivan. Heating, Piping & Air Conditioning, July 1955, pp. 129-136.

30 Air Conditioning Systems Keep Drug

1 VERTICAL DUCTS deliver conditioned air directly above capsule machines in capsule manufacturing room at Eli Lilly's Kentucky Ave. plant in Indianapolis. Room air must be kept within 1 F deg of 75 F DB and 60 F WB to insure that capsules do not stick or crack during production



2 MANAGER OF GRANULATION dry house area has just placed product drying rack in one of 12 McCarty St. plant dry houses. Each of four recorder-controllers shown charts dry bulb and wet bulb temperatures for pair of dry houses and controls steam reheat coils

Capsules and tablets produced at Eli Lilly are processed in environments supplied with conditioned air at very close temperature and relative humidity tolerances. The results: easier, faster handling of products; excellent quality control with lower reject rates.

BY GEORGE M. BENDER
Supervisor of Design
Kathabar Div.
Surface Combustion Corp.

THE CONDITION of the air in manufacturing areas is a vital factor in quality control and production economics in processing extremely hygroscopic powdered pharmaceuticals and gelatin capsules. Precise 24 hr control of relative humidity and temperature means easier, faster handling of the product and lower reject rates in such operations as granulation, tablet compression, and making and filling capsules.

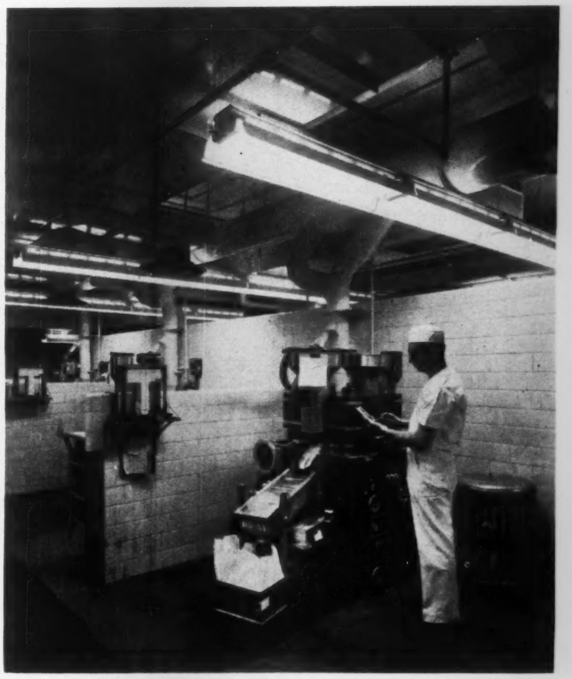
Thirty independent air conditioning systems provide about 350,000 cfm of temperature and humidity controlled air to a wide variety of process rooms at Eli Lilly and Co.'s Kentucky Ave. and McCarty St. plants in Indianapolis.

Because of the inherent characteristics of the pharmaceuticals industry and the continuing growth of Lilly, the company's engineering management fully expects that its air conditioning requirements will expand even more rapidly in the future.

Either of two levels of environmental control must be maintained in certain process rooms at the two plants. In the first level, it is necessary to maintain very precise control over both the upper and lower limits of dry bulb and wet bulb temperatures. The moisture content of the air cannot be permitted to rise above or fall below an optimum range that is peculiar to a given manufacturing operation or product.

Production Rolling

3 EXTREMELY DRY AIR (27 gr of moisture per lb of air) must be maintained in capsule dusting room so that product dust can be completely drawn off surfaces of capsules on suction tables. Wet bulb temperature in room is shown on indicator at left



4 ROOM AIR is at 78 F DB, 57 F WB, 25 percent RH. Supply air is distributed through several ceiling diffusers in tablet compression room at McCarty St. plant. Exhaust duct from tablet machine discharge screen conveys airborne powder back to dust arrestor and filters

At Kentucky Ave. this level of control is most precise in the capsule manufacturing room. Here, temperatures are maintained at 75 F DB and 60 F WB continuously (within ± 1 F deg). If the humidity is too high, the capsules are liable to stick either on the molding pins or together in the tote bins. On the other hand, the capsules may crack, and thus be rejected, if they are manufactured in too dry an environment.

Although allowable ranges of air moisture content vary, other process rooms at the Kentucky Ave. plant are maintained at constant air conditions that are best for each type of operation. Most of the processes are particularly sensititive to air moisture content; eight of the process rooms require relative humidities below 20 percent, with 13 percent maximum maintained in the pulvule filling room.

The second level of environment control is required in those rooms, such as the tablet compression area at the McCarty St. plant, where the maximum moisture content is not only critical but is set at an extremely low level. In this plant, many production processes involve the granulation, coating, compression, and filling of dry pharmaceuticals; gelatin capsules are not involved at all.

The primary concern is excessive moisture because powders that are too moist are extremely difficult to work with and can clog and slow down production machinery. Therefore all the process rooms in the McCarty St. plant are maintained at a relative humidity of about 25 percent, a safety margin of 5 percent below the allowable maximum of 30 percent.

The air conditioning systems at McCarty St. are continuously withdrawing moisture from the air because of the extremely low relative humidity limits. On the other hand, there is a fluctuating total rate of evaporation of moisture from the capsule machines in the capsule manufacturing room, since all the machines are not operating continuously. For this reason and because a high relative humidity of 42 percent is needed — greater than any other process room in the two plants — it may be necessary at times for the conditioning system to add moisture to the air.

In addition to controlling the moisture content of air in all the process rooms, it is also necessary to maintain the dry bulb temperature at a magnitude that is comfortable for employees and yet at a level that does not place unnecessarily high demands on the conditioning systems. Therefore the temperature is maintained at 78 F DB in all rooms where production personnel work continuously.

Establish Design Criteria

The initial cost and engineering time involved in designing the air conditioning systems in the two plants have been minimized by developing a single basic system design that can be adapted to all anticipated process conditions as production facilities grow. The basic system then had to have the following characteristics:

1) Provide conditioned air at a variety of temperatures and relative humidities

● Air conditioning plays a major role in the pharmaceuticals industry, as is evidenced by these two plants of Eli Lilly and Co. in Indianapolis. The two facilities, one primarily engaged in the processing of gelatin capsules and the other in the manufacture of tablets, are supplied with conditioned air at closely regulated temperatures and relative humidities by 30 independent air conditioning systems. While these systems are completely separate, they have the same basic design and afford the flexibility to provide a variety of air conditions to keep pace with the company's development of new products and process operations.

2) Supply conditioned air in different quantities, because of the wide variation in room size

3) Permit installation of additional air handling capacity as needed

4) Maintain precise control of both humidity and temperature

5) Operate continously on a 24 hr basis with minimum downtime

6) Draw air from the outside into the system the year 'round, regardless of wide fluctuations in moisture content and temperature of ambient air

7) Sometimes use a common supply of cooling water at 45 F and steam at 230 F (7 psi) or 270 F (30 psi), to minimize the cost of the plant services required

8) Provide indication and recording of dry bulb and wet bulb temperatures in all process rooms.

It is evident in these characteristics that flexibility of the basic air conditioning system has been extremely important in installation of new additional capacity at a minimum cost. Flexibility is also necessary after a conditioning system is in operation in the event that a new product or operation may be moved into a room, requiring a change in temperature and humidity.

Elements of Basic System

Fig. 5, showing the air conditioning system for the tablet compression room at the McCarty St. plant, includes all the elements in the basic design used in both plants. Although this air distribution system has an air capacity of 25,000 cfm, it is similar to other Lilly systems with capacities from 1500 to 70,000 cfm.

The numerous adaptations of this basic system to the particular requirements of various process rooms involve mostly the function and location of thermostats and humidistats used in controlling temperature and rate of moisture removal in the humidity conditioning units.

As indicated in Fig. 5, 85 to 90 percent of the air introduced to the conditioning system comprises recirculated air from the room and hood exhaust. The remainder is air drawn directly from outside. Hood exhaust, which passes through dust arrestors, amounts to about 15 percent of recirculated air in the tablet compression room and may be as high as 25 percent in the tablet coating room.

The input air to the representative system then goes in sequence through the following steps:

1) *Filters* — Filtration for the most part is accomplished by oil coated, expanded metal prefilters; then either ionizing filters or replaceable cartridge type paper filters.

2) *Humidity control* — Two humidity control systems are comprised of chemical absorbent units which are used in the air circuits for the process rooms. These units comprise either one or two air washers and a solution regenerator.

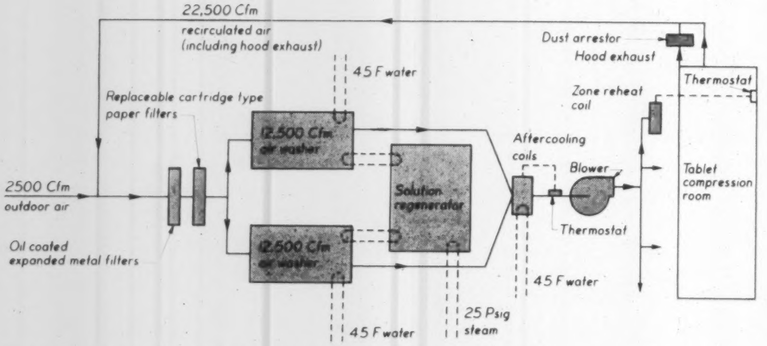
3) *Aftercooling coils* — After a controlled amount of air moisture has been removed and temperature reduced in the humidity conditioning units, the air temperature in the ducts is further lowered to absorb the sensible heat of the room.

4) *System blowers* — With the same air handling capacity as the humidity conditioning units, an individual blower may supply a number of branch ducts to specific zones in the room.

5) *Zone reheat coils* — The heating coils near the discharge end of each zone duct heats the air from the blower to the required temperature to maintain the specified ambient temperature for that zone.

The aftercooling coils reduce the air temperature from the output of the air washer to a value several degrees below the temperature of the room served by the system. Also, the relative humidity is increased slightly, with no change in the moisture content. For the tablet compression rooms the duct air temperature is reduced from 95 to 65 F. The flow rate of cooling water in the aftercooling coils is controlled by a thermostat in the duct between the coils and the blower.

Zone reheat coils are installed near



5 SCHEMATIC DIAGRAM of conditioning system in tablet compression room at McCarty St. plant shown here. Setup is typical of 30 systems serving both Lilly plants the duct discharges in each temperature zone. Operation of these coils is controlled by thermostats located in the appropriate zones of the process room. Again in the tablet compression rooms, the controls have been adjusted so that the zone reheat coils increase the air temperature in the duct near the outlet up to that required to maintain the specified room temperature of 78 F.

Units Remotely Located

Air conditioning units are located remotely from the process rooms in areas least needed for other plant operations but not uneconomically remote from the rooms they serve. At the Kentucky Ave. plant, for example, they are in several groups; three at one point on a mezzanine that is easy to reach but out of the main flow of plant traffic.

A number of the air conditioning units at the McCarty St. plant are on the top floor with other plant air conditioning equipment. All ducts are then run down a single hidden shaft and turned out into the rooms they supply on the floors below.

6 MAIN SUPPLY DUCT and auxiliary distribution duct are located above aisle between two rows of coating pans in tablet coating room at McCarty St. plant

TABLE 1 — TEMPERATURE, HUMIDITY requirements for process rooms in both Eli Lilly plants listed. Note variety of conditions necessary to serve various capsule processes in Kentucky Ave. plant; more consistent environmental control in McCarty St. plant for tablet manufacture

Kentucky Ave. plant

Process room	Temperature, F DB	Temperature, F WB	Relative humidity, percent
Capsule manufacturing	75	60	42
Miscellaneous tablet manufacture	74	51	16
Antibiotic filling	74	51	16
Gelseal manufacturing	69	49	19
Gelseal dry house	84	64[1]	33
Enseal manufacturing	75	55	26
Pulvule (capsule) filling	72	49	13
Pulvule dusting	76	54	20
Pulvule bottling	75	53	20
Pulvule pilot plant	72	50	17
Antibiotic purification	70	49	18

McCarty St. plant

Process room	Temperature, F DB	Temperature, F WB	Relative humidity, percent
Liver powder	78	57	25
Tablet pilot plant	78	57	25
Narcotic molding	78	57	25
Tablet compression	78	57	25
Tablet coating	78	57	25
Tablet bottling	78	57	25
Granulation	78	57	25
Granulation dry houses	65[2]	48	25

[1] In supply duct.
[2] In supply duct. Reheated to 120-150 F near discharge.

The ductwork in the tablet coating area of the McCarty St. plant shown in Fig. 6 is representative of the arrangement of conditioning system elements throughout the two plants. The main air supply duct from the air conditioning units is located in the center of the ceiling between and parallel to the two rows of tablet coating pans. Circular diffusers direct air down from these ducts into the surrounding area.

An auxiliary heater takes room air and heats it all to 90 F, then delivers it into the two circular ducts down the center parallel to the main supply duct. Smaller ducts drop vertically from these auxiliary ducts to supply the auxiliary heated air directly into each coating pan. A similar small duct from each coating pan conveys exhaust back through a dust arrestor to the inlet of the conditioning system.

In Fig. 4, a dust exhaust duct is connected directly from the machine discharge screen into the exhaust system. Note the supply air diffuser directly above the operator of the machine.

Dry bulb and wet bulb temperatures in each process room are both indicated and recorded on circular charts. One temperature recorder for each pair of dry storage houses is located on the walls adjacent to the dry-house doors. As permanent records of instantaneous air conditions, the charts are retained for use in the event of quality rejection later in manufacture.

Design Permits Easy Flexibility

Design changes are made or components added to the basic air conditioning system as required in the individual process rooms. For example, the large tablet filling room at the McCarty St. plant requires an air volume of 70,000 cfm for ventilation. However, because the moisture load is comparatively small and the proportion of recirculated air large, proper humidity control can be maintained by passing only 35,000 cfm through a humidity conditioning unit, comprised of a regenerator, and two 17,500 cfm air washers. The other half of the air flow is passed directly from the inlet filters to the cooling coils.

The dry-house air is delivered from the cooling coils into the ducts at 65 F DB. A separate zone reheat coil for each pair of dry houses is controlled by a thermostat in one dry house to heat the duct discharge air to 120-150 F. Each pair of dry houses also has a separate circulating fan to maintain a uniform drying rate on all trays.

All the electrical power and steam used in refrigeration is charged to the plantwide air conditioning systems as a whole. The cost is prorated to the various departments served by the conditioning systems in terms of the ton-hour requirements for each process room. ‡

the law and your profits

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background. This series presents actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

Contract Must Clearly Define Title

CIRCUMSTANCES which alter an original contract and call for a new one to be drawn up can cause costly troubles regarding title to equipment—as we shall see in this case:

The Sixteen Club contracted with Chose N. Temp & Co. for the purchase of air conditioning equipment to be installed at its rented quarters in an apartment building.

The club agreed to pay $22,550 for the equipment; one-third down, one-third 10 days after delivery of the equipment, and the remainder upon completion of installation. (Ten percent was to be withheld pending the filing of the notice of completion.) Pursuant to the contract's terms, the club paid Temp $7500 on September 17, $7537 on October 26, and $5518 on December 6, leaving a $2000 unpaid balance.

On October 31 the same parties entered into a second contract whereby Temp agreed to furnish and install on the same premises certain additional equipment for $9787. The club paid some $5000 on account, leaving an unpaid balance of $4837.

Neither of these agreements contained any provision reserving Temp's title to the equipment.

Delivery and installation of all the equipment was completed December 19. On January 14, Temp requested payment of the balance due under the two contracts. The club replied that it was unable to pay.

Temp suggested the execution of a "conditional sales contract," by means of which, he said, he could tie up the installed equipment as security.

Such a contract was accordingly executed by Chose N. Temp & Co. as seller and the Sixteen Club as purchaser. This agreement recited that "the seller sell and the purchaser purchase" the equipment covered by the two previous contracts, less cash heretofore paid. This was payable in 12 monthly payments.

It was stipulated that "title to said property shall not pass to the purchaser until all sums due are fully paid." However, there was no change in possession of the equipment at or after the signing of the agreement. It was not notarized nor recorded.

Temp's complacency over this conditional sales gambit was rudely shattered on February 3, when the Sixteen Club went into bankruptcy. The bankruptcy trustee took possession of the club's assets, including the equipment. Thereafter the trustee sold the installed equipment and the club's other property to the owners of the building. This sale was duly confirmed by the bankruptcy court.

Temp made no effort to reclaim the equipment in that tribunal. Instead, he went before the superior court seeking judicial approval of the "conditional sales contract" and contending that title had never passed from him to the Sixteen Club.

The superior court held that the January 14 agreement was *not* a valid conditional sales contract, but was a chattel mortgage which was void insofar as the trustee in bankruptcy was concerned because it lacked "acknowledgment and recordation." Consequently, the building owners acquired title to the equipment when they bought it from the trustee.

Sorely disappointed, Temp carried his case to the court of appeals. There he contended that (1) the conditional sales agreement was valid, and (2) if it was not it was a chattel mortgage, valid between all parties having knowledge thereof, including the trustee and the respondent owners.

If, as the superior court had found, title to the equipment had passed to the Sixteen Club before January 14, that court was "clearly right," said the higher tribunal, in contending that the conditional sales agreement was void as to the club's creditors and its trustee in bankruptcy. This was because "thereby the parties purported to reassign title" to the equipment "without immediate delivery or an actual or physical and continued change of possession thereof."

Lacking such change, "the transfer must be deemed a mortgage." Temp, on the other hand, contended that title to the equipment did not pass to the club before the conditional sales contract was signed. The parties, he claimed, intended that title should remain in his firm under the original agreements until paid for in full and until expiration of 90 days' free service after installation. Therefore, Temp argued, the superior court's decision to the contrary was wrong.

The appeals court did not share his view. Among the reasons for its decision against him were: (1) according to evidence, the parties intended title to pass upon completion of installation because a substantial down payment was made; (2) Temp himself described the conditional sales agreement as a device by which he could "tie up" the equipment as security. The lower court's decision, adverse to Temp, was affirmed. ‡

"Sweat Control" Nomograph Speeds Insulation Thickness Calculations

BY CHARLES F. GILBO
Research and Development Center
Armstrong Cork Co.

ONE OF THE SIMPLE but time consuming jobs in designing air conditioning systems is determining thicknesses of insulation for cold surfaces. The "Sweat Control" nomograph presented on the next page takes the tediousness out of these calculations; gives quick and accurate answers. The user need only follow a few simple steps.

To use the nomograph it is necessary to know any two of the three items listed in each of the following groups. By knowing two of the items, the third listed in that group may be determined.

Group A: (1) cold surface temperature, (2) air temperature and relative humidity, and/or (3) insulation thickness needed to have its surface temperature equal to the dewpoint temperature of the air.

Group B: (1) air temperature, (2) air dewpoint temperature, and/or (3) air relative humidity.

Group C: (1) cold surface temperature, (2) air temperature, and/or (3) insulation surface temperature.

The thicknesses shown in the nomograph are for flat surfaces and must be converted to equivalent thicknesses if the insulation in question is on cylinders of less than 36 in. diam. The formula $r_2 \ln (r_2/r_1)$ may be used for this purpose; where r_1 and r_2 are the inner and outer radii, respectively, of the insulation.

The nomograph was developed in two major steps, the first being that part used to determine the insulation surface temperature. This was done by mathematical means and is not based on experimental studies of sweat control, except for establishing the surface film coefficient.

It is known that the air film coefficient can vary from 1 to 2.5 due to small changes in environment. Without a great amount of experimental work to study the effect of these changes in environment upon the surface film coefficient, all heat flow calculations based upon this coefficient are only approximations.

The value of 1.65 is suggested by Gordon B. Wilkes in his book *Heat Insulation*. This value was also verified by experimental work carried out in our laboratory. By operating cold lines insulated with materials of known properties in a carefully conditioned room it was possible to make measurements of the insulation surface temperature. The measurements were then used in the following formula, and the air film coefficient calculated.

$$h = [k(t_2 - t_1)]/[r_2 \ln (r_2/r_1)\ (t_3 - t_2)]$$

where:

t_1 = cold surface temperature, F
t_2 = insulation surface temperature, F
t_3 = air temperature, F
h = surface factor or air film coefficient, Btu per sq ft per hr per F deg
k = thermal conductivity, Btu per sq ft per hr per F deg per in.
x = insulation thickness, in.
r_1 = inner radius of insulation
r_2 = outer radius of insulation.

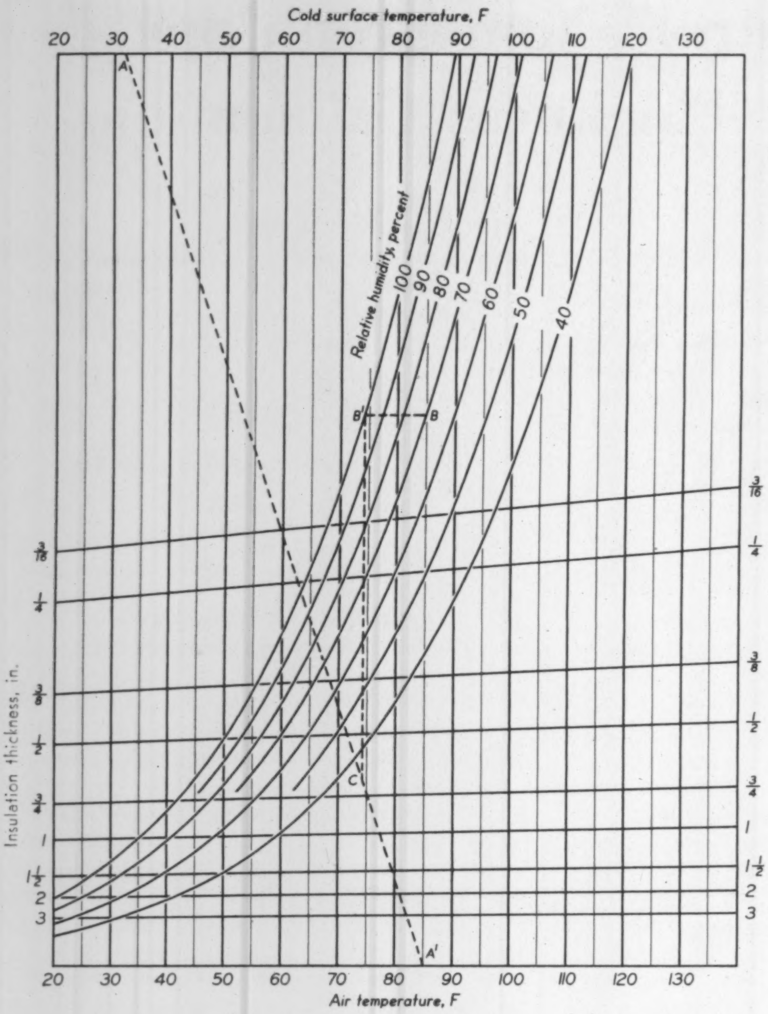
The results of this work indicated a wide variation in surface coefficient with a maximum of 9.5 to a minimum of 1.6 Btu per sq ft per hr per F deg. Most of the values fell between 2.0 and 1.6.

An examination of any of the formulas used to determine insulation surface temperature will show that the lower the surface coefficient the lower will be the determined temperature. If the calculated surface temperature is the lowest that would be expected in practice, as shown by our experiments, then the following calculations will be for the minimum protection that would be expected. The only exception to this would be in the case of horizontal or nearly horizontal surfaces with the heat flow downward. The surface coefficient in this case is about 1.3. It must be remembered that in these calculations the point of failure or sweating was taken when the surface temperature equaled the dewpoint.

With the foregoing studies as a guide, a film coefficient of 1.6 was chosen for use in the calculation of insulation surface temperature. Several hundred calculations were made to establish the insulation surface temperature when the insulation thicknesses, air temperatures, and cold surface temperatures were varied. The following formula was used to make these calculations:

$$t_2 = [h\ (t_3) + (k/x)\ (t_1)]/[h + (k/x)]$$

An initial set of calculations was made using estimated mean temperatures of the insulation to establish the k value to be used in the formula. To help in this phase of the work a graph was drawn using the thermal conductivity as the ordinate and mean temperature as the abscissa with $k_{70} = 0.27$ and $k_{90} = 0.28$ the average values for insulation of the type now commonly used on air conditioning systems.



THIS NOMOGRAPH can be used to determine thickness of insulation needed to give sweat protection when cold surface temperature, air temperature, and relative humidity are known. It can also be used to determine sweat protection afforded by a given thickness of insulation when air and cold surface temperatures are known. Nomograph applies to flat surfaces covered with material whose thermal conductivity is:

$k_{70} = 0.27$ $k_{90} = 0.28$

To find thickness of insulation needed to give sweat protection, simply follow the steps taken in this example: Assume a cold surface temperature of 32 F (point A) and an air condition of 85 F at 70 percent RH (point B). Locate 85 on air temperature scale (point A') and connect it with a straight edge to cold surface temperature (point A). Next, find dewpoint of air by following a horizontal line from air condition (point B) to saturation line (100 percent RH). Dewpoint is 74 F (point B'). Finally, to find insulation thickness, locate dewpoint temperature on line AA' that was previously located (point C) and read off thickness. In this case, answer is ⅝ in. of insulation. By reversing procedure, degree of protection a given thickness of insulation will afford can be determined

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After considerable experimentation and several failures at drawing nomographs, the basic ideas now presented were developed. A small nomograph was then used to obtain the first approximation of surface temperature so that a more accurate mean temperature of the insulation could be determined. With this new value, additional calculations were made for use in drawing the final nomograph. Calculations were made using cold surface temperatures and air temperatures from −60 to 120 F and insulation thicknesses of 3/16, ¼, ⅜, ½, ¾, 1, 1½, 2, and 3 in.

The results of the above calculations were then plotted in nomograph form and checked, using the following formula:

$$t_2 = t_1 + (R_i/R_T)\ (t_a - t_1)$$

where:

R_i = thermal resistance of insulation, x/k
R_a = thermal resistance of air, $1/h$
$R_T = R_i + R_a$
All other symbols are as previously used.

The results of 22 calculations indicate that the nomograph values for insulation surface temperature check within +0, −1 F deg.

Further check calculations revealed differences as great as +1.4, −3.3 F deg in the insulation surface temperature. It was found that some of this difference could be accounted for in the choice of parameters used. The values obtained by this series of calculations were used to modify the development of the nomograph in its final form so that a check of +0.7 and −1.2 F deg is obtained. The above calculations were made using the following formula:

$$t_2 = [(t_a/R_a) + (t_1/R_i)]/[(1/R_i) + (1/R_a)]$$

After the first part of the nomograph which related air, cold surface, and insulation surface temperatures was drawn, it was used as the foundation of the final one. By using the air temperature scale as used on the foundation nomograph as the scale for a psychrometric chart it was possible to develop the nomograph as presented. ∓

SAMUEL R. LEWIS, consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.

Sam Lewis says:

"When Winter Came, This Utopia Dissolved"

HERE'S A YARN about the air conditioning of an office building for a manufacturing plant. The owners' pride changed to chagrin once winter came.

The single-story structure, comprising eight rooms, is conditioned via 10 ceiling diffusers by a single air supply unit in the attic. This complex unit has a refrigeration compressor, a direct expansion evaporator, two air supply fans, an electric motor, a steam heating coil, a dust filter for outdoor air intake, and an evaporative condenser on the roof served with circulating water by an electric pump.

A single thermostat, adjusted in summer to start and stop the compressor and in winter to open and close a steam supply valve to the steam heating coil, is the only means for controlling the temperature for the entire building.

A recirculating air duct leads to the intake of the unit from a grille near the floor of each room, and an outboard exhaust duct leads from the ceilings to an exhaust fan.

The rooms have different sizes and, consequently, individual characteristics that govern the demand for heat input or removal.

A trunk line air delivery duct runs in the attic from the unit, with a branch duct to each room. Each branch duct has a manually adjustable damper which is accessible only by someone climbing to the attic level. This person must guess at the correct damper readjustment. One branch duct may have been receiving too much air; reducing this volume necessarily increases the volume delivered to the other rooms.

The occupants of this office lived fairly happily during the first summer. The refrigerated air, being cooler and heavier than the air in the rooms, would drift down around the occupants and the warmer air, being lighter, would gather near the ceiling and escape through the exhaust outlets. The recirculating ducts were inoperative under this summer condition. There was no supply of artificial heat to the building except that carried in by the air.

When winter came, this Utopia dissolved. The thermostat was switched from control of the refrigerated cooling to control of the steam supply to the heating coils. The warm air entered each room at the ceiling — and was exhausted at the ceiling. There were a lot of cold feet and knees.

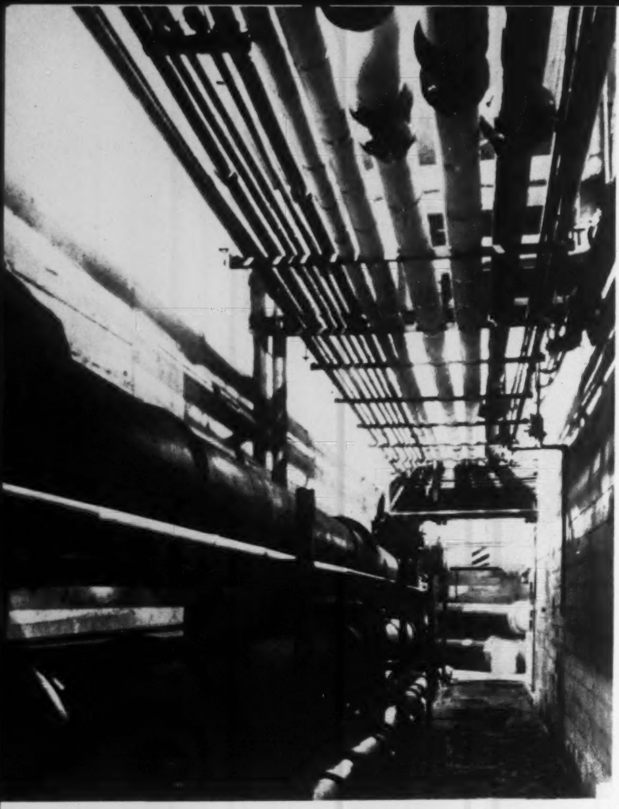
In an attempt to correct this situation, the exhaust fan was stopped. This was done in the hope that the cool air at the floor would be removed through the recirculating ducts. With the exhaust fan stopped, air circulation was reduced and the outdoor air entered very slowly. Odors from spent air became noticeable. Much time was consumed running to the attic to adjust and readjust the dampers in the air supply branch ducts.

After a thorough investigation of this sorry state, I prescribed that the exhaust fan be relocated so that it would take air from the recirculating duct, with interlocked adjustable dampers, to the end that all or any desired part of the air handled by the exhaust fan would be delivered back to the supply unit or else be forced out through the roof. Also, a direct radiator was added at the floor in each room so that ultimately the uninsulated heat losing concrete and mud under it would become humanly warm. This was done by employing mechanically circulated hot water. A separate thermostat in each room controls the radiator valve. The original thermostat continues only as a winter-summer device.

These repairs cost about a dollar for each cubic foot per minute of air handled.

This installation gives rise to some good axioms to follow in designing air conditioning systems:

- Delivery and exhaust of warm air limited to openings at the ceiling do not make for comfort heating.
- Recirculation of air within a building works better if the exhaust fan assists the supply fan.
- Acceptable air conditioning requires dilution of spent interior air with new air from the outdoors.
- Approach with suspicion the failure to provide insulation or its equivalent between a floor and the ground.
- Make it easy for the room occupant to adjust the temperature — by turning a valve or adjusting a thermostat rather than make someone climb to the attic and guess at the clearance of an invisible damper.
- An exhaust outlet through a roof should look *up;* a gooseneck outlet is a funnel and is likely to become an inlet when the wind looks into it. ╪



Oceanarium Simulates the Briny Via Elaborate Piping System

So denizens of the deep can frolic in tempered sea water while tourists look on

BY J. MARX AYRES
Consulting Mechanical Engineer

● **Sea water—filtered and heated or cooled according to the marine display—is supplied to Marineland of the Pacific by an elaborate piping system and mechanical plant. Two motor driven deep well pumps located at sea level deliver sea water to two banks of sand filters at the oceanarium, 100 ft above sea level. Water is then pumped by two horizontal split case pumps to two large visitors' viewing tanks and to a storage tank which, by gravity, feeds smaller tanks. More details on this installation appeared in the February issue.**

Mr. Ayres, now a consulting mechanical engineer, was chief mechanical engineer for Pereira & Luckman at the time that firm designed and supervised the Marineland of the Pacific project. Later, he was retained as consultant to Marineland.

FILTRATION for the sea water systems at Los Angeles' Marineland of the Pacific consists of eight concrete 18 × 20 ft gravity sand filters separated in two banks of four. One bank serves each of the large tanks. Filter bottoms are precast concrete, with depressions containing porcelain balls, supported on concrete block piers. The bottoms are covered with graded gravel for 12 in. and topped with 30 in. of filter sand.

Backwash troughs above filters are v-shaped precast concrete 24 in. above the filter sand. The space between the two banks of filters is a pipe gallery about 20 ft wide containing two 3500 gpm recirculating pumps, hydraulic valves, and interconnecting pipes, drains, etc.

The main filtration plant for the oceanarium is located on the seaward side of the circular tank. The upper level of the plant houses the central control station and the lower level opens to the pipe gallery and underground pipe tunnels.

The filtration system for this plant is different from the usual gravity sand filtration system in that it contains no clear wells for backwashing. Piping and valves are arranged so that one pump can draw 3500 gpm of clean water from under a bank of four filters and discharge it under one 18 × 20 ft filter for backwashing. This design incorporates about 2.5 gpm per sq ft filtration rate and 10 gpm per sq ft backwash rate. No rate of flow controllers are used on the backwash and no flocculation is used in filtration.

At the seaward end of the filters, two concrete tanks either receive the backwash water or return water from the tanks, depending on the position of the hydraulic valves in the interconnecting piping. A filter control center is located near the other end of the filter. This contains the hydraulic valve control panels, electric control center for pumps, and other equipment and instrument panels for the entire hydraulic plant. From this point, the operator can read water levels and temperatures in various tanks, keep continuous records of sea water flow rates from the pumps at the beach, and operate all pumps and hydraulic valves.

Design for Accessibility

Concrete pipe tunnels extend from the filter pipe gallery under both large tanks and to other areas, such as the boiler room and pipe shafts. These tunnels are well ventilated, and well lighted to assist in servicing. All pipe connections to the large steel tanks are kept accessible for continuous inspection. Rubber expansion joints absorb the approximately 1 in. tank deflection that occurs between full and empty tanks. All piping in the tunnels is racked along the walls and overhead and is painted for identification.

All underground tunnels are sloped to an emergency drain to the sea. This is sized to allow a man time to escape if major pipe or tank leaks develop.

The selection of pipe and pump materials in this project was approached from two points of view: the chemical content of the water as it affects the fish and mammals displayed, and the replacement costs due to corrosion. Inert materials were used where possible and practical.

All sea water supply and drain lines 3 in. and larger inside the structure are cement lined cast iron pipe made up with mechanical joints. Similar lines outside the structure are underground and are of cement asbestos. Gate and check valves in these larger sea water lines are made of nickel chrome-moly cast iron with 18-8 stainless steel disc faces, seat rings and stem, and bronze body and bonnet. Sea water lines $2\frac{1}{2}$ in. and smaller are plastic. All gate valves in these small lines are rubber lined cast iron, rubber diaphragm type and all check valves are 18-8 stainless steel.

The circular and oval tanks each have a 40 hp, 3500 gpm horizontal split case recirculating pump operating against a 40 ft head. These pumps have cast iron casings, impellers, wearing rings, and bushings, and monel shafts and sleeves.

Under normal operation each unit pumps filtered water from under one bank of four filters and discharges it into the tank through four 8 in. jets in the tank bottoms. This water leaves the tank through a center drain and flows by gravity back to the top of the sand filter.

Heat Tropical Fish Tank

The oval tank, for display of tropical fish, has its water tempered to 70 F by means of two immersion hot water heat exchangers rated 1 million Btu per hr each. These exchangers are made up with monel tubes and naval bronze heads, and are located in a concrete tank adjacent to the bank of filters supplying the oval tank.

They are suspended on brass hangers tied to wood beams that span the top of the tank to facilitate removal and inspection. This installation method was selected over shell-and-tube heat exchangers since it is desirable to keep the exchangers accessible for inspection and repair.

Since the water for the oval tank is heated, it is recirculated most of the year to save on fuel bills. The system is arranged, however, so that varying amounts of raw sea water may be introduced into the system if desired.

Water returning from the oval tank is aerated to increase the oxygen content in the water and reduce the bacteria growth. The water passes through a perforated 14 in. diam pipe forming fourteen hundred $\frac{3}{8}$ in. jets of water that project the water 2 ft into the air before it falls into the same tank that contains the heat exchangers. The water in the aeration tank then passes over the heat exchanger before it is discharged to the top of the oval tank filter.

The temperature of the water in the circular tank is allowed to vary with that of the incoming raw sea water. The recirculating pump for this tank operates similarly to that described for the oval tank, except that there is no aeration. Under normal conditions the incoming 2000 gpm of raw sea water is pumped directly into this tank along with the 3500 gpm of recirculated water. Excess water is then wasted by gravity to other smaller outdoor tanks and the sea arena, finally spilling down the cliffs into the sea.

The heavy makeup water greatly assists in maintaining the clarity of water in this tank where the mammal excretions of the porpoise and whale are excessive. Depending on the seasons and operating conditions, portions of this 2000 gpm of raw sea water are pumped into other tanks. The piping system is arranged so that raw sea water may be supplied to all tanks upon demand.

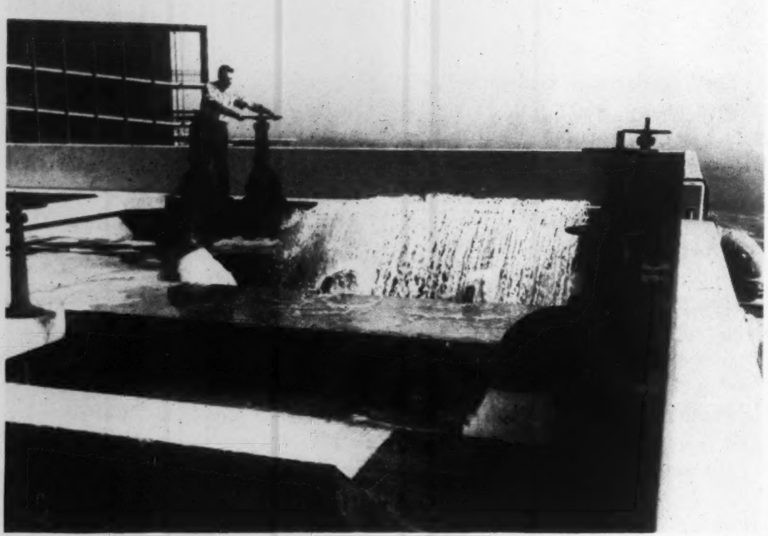
Water entering both the oval and circular tanks is chemically treated. Each system has a 110 gal rubber lined solution tank fitted with a direct drive mixer and a proportioning injection pump. A copper sulfate base solution is fed into the large tanks to inhibit the growth of algae and reduce infection and disease among the fish and mammals. Without this chemical control the tank walls and viewing windows would be covered with green algae in a matter of hours.

How Other Tanks are Supplied

A 20,000 gal gunited steel tank on the third floor stores raw sea water for use in the many smaller display tanks, laboratory, etc. It is supplied from the main sea water makeup line and is tapped off manually by the operator as required.

This tank has an immersion heater similar to the one serving the large oval tank except that the temperature of the sea water leaving the tank is automatically controlled to deliver 75 F water. This is done by an immersion thermostat controlling a three-way valve in the hot water lines to the heat exchanger.

The water is supplied at one end of the tank and taken out at the other. The heat exchanger is mounted near the outlet and the water in the tank



THIS AERATOR increases oxygen content and reduces growth of bacteria in water for large oval tank. Water to various tanks is heated or cooled, depending on displays on exhibit

is agitated to prevent stratification of the warmed water by means of a small pump mounted within the tank. Water from this tank is supplied by gravity at varying rates depending on the laboratory activity and number of tropical fish displays.

A series of small display tanks for special fish exhibits is adjacent to the laboratory on the first floor. These "jewel" tanks are about 48 × 24 × 30 in. in size, with glass walls in front and rear. They are served by a bank of lines carrying raw, tempered, and chemically treated sea water as well as fresh water, compressed air, and gas. Tanks are supplied through rubber hoses from pet cocks in the overhead pipes and drained by hoses to a concrete floor trough.

This same network of pipes is extended into the adjoining laboratory where experimentation and research are carried on. All floor drainage in these areas is carried to the main drain to the sea in brass floor drains and cement lined cast iron pipes.

A 16 × 7 × 4½ ft deep tropical fish tank is located on the second floor. This tank is similar to the "jewel" tanks in function, but is much larger. In addition, it has bottom supply jets around its perimeter which induce rotational water movement. Tempered sea water from the storage tank is supplied at one change of water every four hours. Compressed air is supplied through diffuser stones on rubber hoses attached to overhead compressed air lines.

Chill Octopus Tanks to 50 F

Very few octopuses are kept alive in aquariums because they are very sensitive to water temperature and chemical content of water. In fact, they require 50 F or colder water to simulate their deep water ocean habitat. Marineland of the Pacific maintains two octopus tanks, one for display to the public and one in the laboratory for standby and experimentation.

The tank for public display is 17 × 9 × 6 ft deep and is constructed of gunited steel, with one wall of double glass for viewing. It is located on the third floor between the oval and circular tanks. A scuttle access through the floor of the top deck above permits cleaning the tank and caring for the specimens. Sea water is supplied at about eight changes per hour. This water is recirculated continuously through a pressure sand filter and a glass shell-and-tube heat exchanger.

The refrigeration plant for this tank consists of a 3 ton water cooled refrigerant No. 12 condensing unit operating through a heat exchanger which cools methyl alcohol. The methyl alcohol in turn is passed through the shell of the glass heat exchanger which cools the sea water pumped into the tank. The refrigeration compressor is cycled automatically to maintain 50 F water leaving the tank.

The viewing glass in the tank is double glazed to reduce condensation. Tank walls, floor, and top have vapor barriers and insulation.

The sand filters are designed for fresh water backwash, followed by raw sea water rewash. The plant is arranged so that up to 25 percent of the water supplied to the tank is raw sea water. This excess water is continuously discharged through the tank overflow to the main drain to the sea. Water is introduced into the tank through bottom jets similar to those in the tropical fish tank and is taken out through a center drain in the bottom. Water may also be introduced through a perforated pipe supply located in the tank above the water surface.

All mechanical equipment for the tank is in a room immediately adjoining the tank. The sand filter is plastic lined steel with plastic pipe underdrain and is fitted with manually operated hydraulic valves. Pumps are all cast iron with monel shafts and sleeves.

The laboratory octopus tank is 4 × 10 × 4 ft deep and is made of wood with an open top for access and observation. The water system is similar to that described for the main octopus tank. The wood tank is set up on wooden legs and surrounded with a curbed concrete floor pitched to a floor drain to collect condensate that forms on the tank walls and bottom. The refrigeration plant, heat exchanger, filters, etc., are similar to the main octopus tank's except reduced in size.

Outside the main oceanarium are four tanks that support and enlarge the main displays. All of these are at ground level and are supplied by gravity with waste water from the oval and circular tanks. Water is passed through these tanks and then discharged into the main drain to the sea. The piping is arranged, however, so that raw sea water may be pumped directly to them if necessary.

The two holding tanks are 30 ft in diameter and 5 ft deep and are located in an adjoining service area seaward from the main filter plant. These tanks are used to hold specimens for several days for observation before placing them in the main tanks. They are reinforced concrete with two 2 in. bottom jets near the outside of the tanks, and a center drain to sea. The jets create rotational action of the water in the tank, and this motion plus the center outlet assists in tank cleaning.

Since the drainage is by gravity, the drain line is provided with an inverted "U" 48 in. above the tank bottom. This is vented at the high point and valved to prevent complete loss of water if the supply is interrupted.

Use 100 Percent Outside Air

The concourse areas around the oval and circular tanks are ventilated by a forced air system using 100 percent outside air. Due to low head room and floor space limitations, these areas are necessarily supplied from eight risers made up of plastered furrings extended between the exterior columns and the outside walls. These vertical plenums have high sidewall supply registers at each floor and are fed from large cement asbestos pipes located below grade.

Ventilation piping ranges from 20 to 36 in. in diameter, and all fittings are made up of sheet metal encased in concrete. The cement asbestos pipe is of the industrial ventilation type and is, in general, run outside of the main structural footings to avoid excessive crushing pressures. Where this could not be accomplished, 300 psi pressure cement asbestos pipe is installed. The use of this distribution system proved less costly than concrete trenches, due to the irregular shapes encountered in the total structure outline.

Three built-up fan systems are used in the ventilation system made up with cleanable filters, hot and bypass decks, and separate zoned takeoffs. The systems are designed to supply between five and eight air changes per hour, depending upon the anticipated heating requirements. A large public lounge on the first floor has a glass wall 140 ft long × 20 ft high. Continuous baseboard discharges air straight up the glass.

Air is exhausted to the outside through grilles located over the many doors leading from the concourse area to the ramps on each floor. Some of the excess air is exhausted through the several toilets, work spaces, and parts of the laboratory. Also, provisions are made to draw some of the excess air through the pipe tunnels, pipe gallery, and pipe shafts to keep them moisture-free. The laboratory itself has a separate fan and coil supply unit and exhaust system.

Heating coils and piping for the fan units supplying the public areas were eliminated at time of construction in an economy move and have not as yet been installed.

Plan For Expansion

The central boiler plant is designed to house four hot water boilers, but only two are installed at present. The boilers are fire tube steel type units, fitted with induced draft fans and combination gas-oil burners. The boilers are each rated 2 million Btu per hr output each and serve the salt water immersion heaters, the domestic hot water system, the laboratory heating and ventilating system, and the direct baseboard radiation installed in the administrative offices, divers' lounge, and various other areas.

The space for the future boilers is reserved in case the management decides to heat the public concourse areas and the sea water in the circular tank. Boiler water is chemically treated. The cold water makeup line to the hot water system is fitted with a water meter whose job it is to record any loss of water to areas such as the immersion heaters in the salt water systems.

Treat Sewage Before Disposal

Fresh water and natural gas are obtained from adjacent public utility company lines. Public sewers are not as yet installed in the area and a private sewage treatment plant had to be installed for the project. This plant is located between the main oceanarium structure and the ocean, and the plant effluent is discharged into the main 24 in. drain to the sea from the oceanarium.

The treatment plant effluent is periodically checked for bacteria count by the State of California Health and Water Pollution authorities. All outside sewer lines are cement asbestos pipe made up with rubber ring joints and employing precast concrete manholes.

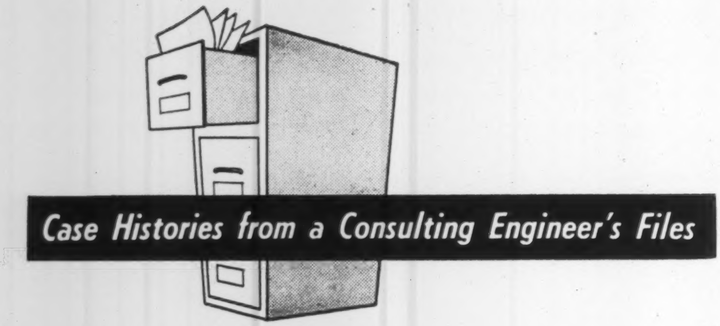
Fresh water is supplied at about 200 psi and is reduced at a central station to 150 psi for outside distribution to the fire hydrants and the various structures. Water pressure is further reduced at each structure to 60 psi for inside distribution.

Since the facility contains sea water, the California health authorities require a reduced pressure backflow prevention device on all fresh water supplied to the site, as well as special backflow prevention devices on all fresh water lines within the structure that are connected to sea water tanks. All outside water lines 3 in. and larger are cement asbestos pressure pipe, and lines 2½ in. and smaller are wrapped galvanized steel.

Emergency power standby is provided to the site by means of a diesel motor generator sized to keep the main salt water pumps and air compressors in operation at all times.

The compressed air system extends throughout the structure and is used by the divers in the main tanks, for the aeration of the many smaller tanks, and for the laboratory. The two 3 hp air compressors have nonlubricated cylinders, water cooled aftercoolers, and numerous drip traps to assure the safety and health of the divers. All compressed air lines are copper with sweat fittings.

Pereira & Luckman were the architects and engineers. N. C. Ebaugh, consulting engineer, designed the preliminary water system. The mechanical (heating, piping, and air conditioning) contractor was Mehring & Hanson Co. ⧺



Case Histories from a Consulting Engineer's Files

By C. T. BAKER
Consulting Engineer

Modern air conditioning systems, for efficient and satisfactory operation, must be correctly designed. Here are five typical cases from the author's experience where original design was faulty and had to be corrected.

• a new low in what not to do when designing air conditioning

TWO SEPARATE air conditioning systems served a particular institution. One had been in use for many years, and the other about three years. The writer was asked to determine why the overall operation of the two plants was so unsatisfactory. Some interesting conditions were disclosed.

One installation, with a multi-cylinder vertical compressor and the necessary automatic controls, supplied the air cooling requirements. A splendid machine, it was found to be operating entirely satisfactorily.

However, a curious thing was discovered about the condenser installation. The evaporative condenser had been placed in a room about 12 × 12 × 10 ft high, with no provision for bringing outside air into the room. The only outside air, which was very little, was that which managed to creep in through the window and door facings, or cracks.

Further, a water heating system, supplying hot water to the building, was installed within a few feet of the condenser air intake. When this heater is operating, which is most of the time, the flow of air is from the outside to the inside of the building, due to the difference in absolute pressure between the air-starved room and the outside. This permits most of the waste products of combustion from the gas fired burners, to enter the room and, in turn, be picked up by the fan and drawn through the water spray of the evaporative condenser.

In order to increase the air input to the evaporative condenser, two small fans were placed opposite the air intake opening to the condenser and operated to increase the air input and thereby improve condenser performance. This bright idea, of course, failed to produce any tangible results. In checking the operation of this condenser, it was found that one of the reasons for the poor showing was that the spray water pump operated in the wrong direction. Still another cause of failure to perform was the arrangement for handling the superheated water vapors discharged from the unit. These vapors were discharged to the outside of the building near the ground line, from where some were pulled down the stairway, back into the basement space and into the condenser. Most of the vapors not returned to the basement were picked up by the fan in a $3/4$ hp window type air conditioner close by, cooled to the dew point, and drained off as water, thus increasing the latent load on the unit.

Much of the expensive insulation that originally had been placed around the cold air ducts had been improperly applied and was not effective. In fact, a great deal of the cold air duct surface in the non-conditioned space, had not been insulated at all, which, of course added to the load on the plant. One particular offender was the general utility shaft leading from the basement to the attic space in which one of the main conditioned air supply ducts was installed. This exposed duct was having a very decided effect on plant capacity.

In the original plant, some extraordinary blunders were also discovered. A spray type water cooling tower inside the building included a fan arranged to pull air through the tower and discharge it to the outside through some 50 ft of round discharge duct. Since the fan was not designed to handle air against an external static pressure such as that created by the long discharge duct, the tower, as a cooling agent for the condensing water, was not effective. In order to improve the overall operation, a large fan had been installed on the opposite end of the tower and operated to force air through the assembly, but this did very little good.

The prevailing condensing pressures of this plant ran anywhere from 20 to 30 psig higher than would have been the case if the cooling tower, water circulating pump, and water piping had been properly installed.

The compressor motor operates considerably overloaded and at a temperature much higher than the ambient air.

No pressure gages were provided with this installation, nor was there a liquid drier for removing moisture from the liquid fluorinated hydrocarbon refrigerant.

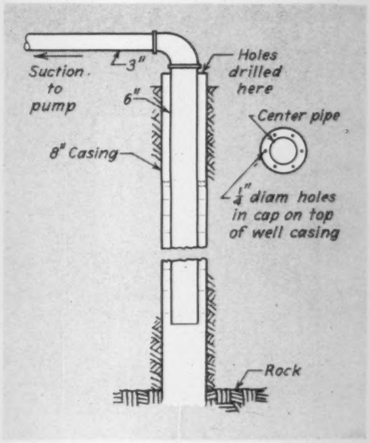
By and large, these two air conditioning installations represent a new low in what not to do. Just as long as air conditioning systems are installed in this manner, the buying public will likely remain critical and suspicious. The industry cannot afford public reaction that may be detrimental.

• not enough air to insure required flow of water

A CENTRIFUGAL PUMP with a capacity of 150 gpm was connected to a well that supplied a part of the plant condensing water. However, it was soon found that the pump was not supplying water at anywhere near the expected rate. The reason for its failure is illustrated.

It is evident from the sketch that there was no chance for air to act directly on the water in the well except as it may have acted through the sand on the water bearing strata which was not sufficient to insure the required flow of water from the well to the pump.

After drilling holes in the well cap as shown, the pump performed satisfactorily and delivered its full quota of water.



• almighty dollar is cause of many poor air conditioning systems

RECENTLY, I spent some time in several drug stores in three different cities. The front door of each store displayed a conspicuous sign reading, "This store is air conditioned. It is several degrees cooler inside." This was true. A package type air conditioning unit, either water cooled or air cooled, served each place. All units were the products of responsible and well known manufacturers in the field.

However, regardless of the fact that the installed equipment was good, satisfactory air conditioning was never obtained. The reason: no ventilation. Each store had to be content with stale, lifeless, ill-smelling air, all because someone lacked the integrity to insist on providing sufficient outdoor air to insure at least the minimum number of required air changes per hour.

When finding such situations, I am always interested to discover the reason why. The answers I get from most of my questions fall into three categories:

1) "I didn't know that you had to have outdoor air when you install an air conditioning system; no one ever told me that I did."

2) "I asked about fresh air, but the salesman said I really didn't need it, but that it could be provided if I was willing to pay more for the unit. It seemed that a bigger, more expensive unit would have to be installed if outside air had to be cooled, so I decided against spending the extra money."

3) "Frankly, I didn't want to spend any more money. Besides, the opening of doors, with customers constantly going in and out, lets in a lot of fresh air."

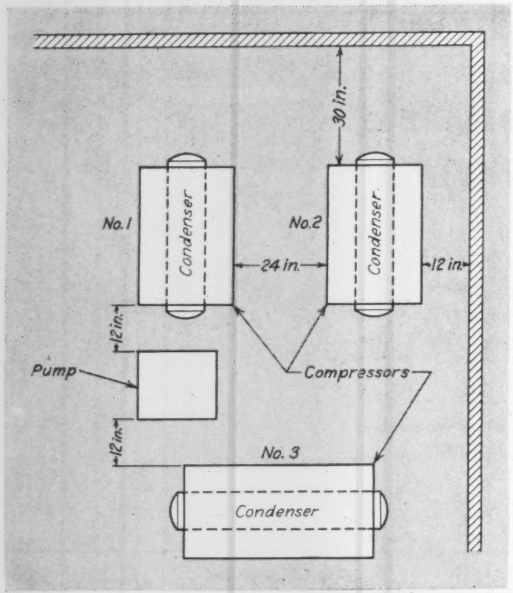
One man with whom I talked had a 7½ ton unit in his store. He said, "Had I been told the facts when I bought my equipment, I would have installed two 5 ton units and would now have the right kind of air conditioning job. As it is, I get mostly complaints about stale, dead air from customers who never hesitate to express themselves.

"This fall," he continued, "I am

going to buy a larger unit or two new ones of the size I now have, but not from the same contractor. For years I've been reading advertising ballyhoo about air conditioning being so great, but it hasn't been for me."

It is unfortunate that such practices are so widespread. They inevitably result in public criticism of air conditioning and create resentment which reacts unfavorably on the industry that has accomplished wonders in the field of human comfort during the past quarter of a century. The seller and the buyer are both sometimes at fault. Reduced to its simplest terms, it is generally the "almighty dollar" that decides the issue.

• cramped quarters will make maintenance a real chore



RECENTLY I had the opportunity of looking over a new air conditioning plant while waiting for a train. The machinery room was so crowded and the equipment so closely grouped with but little space between, that I first thought that I had entered the portal of a "modern" air conditioning plant, since the pattern of this crowded plant had all the earmarks of the many so-called air conditioning plants found in every community.

There is only 12 in. of space between No. 1 unit and the condenser pump and only 14 in. of space between the pump and No. 3 unit, while No. 2 unit is only 12 in. from the wall of the building.

The interesting thing about this cramped installation is that all of the space was needed merely to get the equipment installed. Ample working space all around each unit could not be provided. The fun will start when it becomes necessary to clean the condenser tubes or to replace one in case of a leak.

• short-cut practices may be costly

THE COMPRESSOR in a processing plant was too large for the load resulting from the heat supplied from the chill and aging rooms. Result: low evaporating temperature in the unit cooler, a wide range between entering and leaving air temperatures, and finally, a serious case of drying out the product after a few hours in storage, due to the low relative humidity of the circulated air.

Two things were needed:

1) A larger diameter pulley on the compressor.

2) A suction pressure regulating valve on the combined suction outlet of the two evaporators.

The owner suffered a continuous loss in revenue while he spent weeks arguing with the mechanical contractor, who had made the installation, in an effort to have the contractor make the changes without cost to the owner.

Months later, after costly delay, a compromise was reached and the needed changes made.

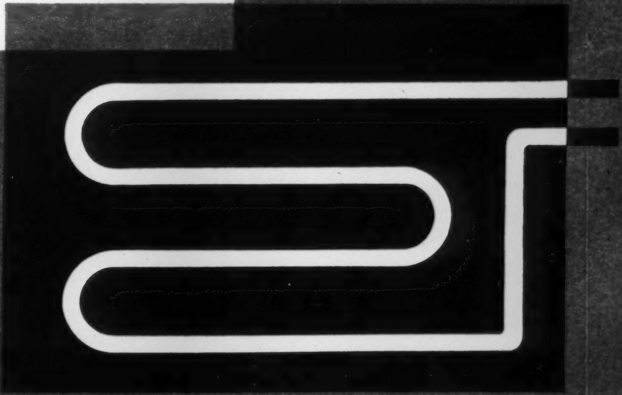
To footnote this case, "Mr. Big Dome," the owner, could not see the forest for the trees. In these days of high production costs, high taxes, and high overall cost of operation, owners of plants of all kinds cannot afford to follow practices that were in vogue a quarter of a century or more ago. Modern equipment and modern methods are more essential today than ever before.

Persons who believe in and insist on a complete installation — minus frills, of course — cannot understand why some owners and contractors do not have a meeting of the minds before work is started and an agreement that includes all equipment essential for a complete installation.

Unless the short-cut practices in air conditioning design and installation are eliminated, public reaction may prove costly to the industry as a whole. ‡

How to Prevent Failures in Radiant Heating and Snow Melting Systems

Experience indicates the need for careful design, installation, and maintenance procedures to prevent loss of heating effect, leakage caused by corrosion, and other undesirable effects in these systems.



Radiant heating and snow melting systems must be expected to perform satisfactorily for many years without major repairs. Since their piping systems are embedded in structural components, repairs are expensive and inconvenient, and, in some cases, impossible to make. Thus, every precaution should be taken during design and installation to make certain that failure will not occur.

The engineering design of the thermal aspects of such systems is important. But other factors, oftentimes less obvious, must also be given attention according to Samuel H. Nitzberg, a special contributor to this HPAC Engineering Data File and president of Atlantic Pipebending and Fabricating Corp. Mr. Nitzberg has for 15 years fabricated and installed radiant heating and snow melting systems. Because of his practical knowledge of the factors involved, he has frequently been asked to inspect problem jobs to determine the cause of trouble. The examples of failures given here and the many recommendations, unless attributed to other contributors, are taken from Mr. Nitzberg's experience over the past years.

Some of the points that must be observed are protection of concrete slabs from ground water, proper support and encasement of piping, avoiding contact of piping with dissimilar metals and materials, proper allowance for venting and balancing, and proper mixing and placement of concrete. Consideration should also be given to the properties of heat transfer media in snow melting systems and the means by which they can be maintained to provide satisfactory performance. Observing these and other precautions in design and installation will help to insure long-time satisfactory performance of these systems.

How to Prevent Failures in Radiant Heating and Snow Melting Systems

A FAILURE of a radiant heating or snow melting system doesn't just happen. As with any equipment, it's caused by one or more reasons — in some cases, by the engineer's lack of complete information, knowledge, and understanding of all the factors that should be considered before completing his design. In other cases, a failure may be caused by poor installation techniques.

A discussion of failures that have been observed should be helpful in improving design and installation practices. Many phases of the subject that have been observed in existing installations have not been touched upon by formal research and have not been reported. This report will attempt to outline some of the factors to be considered and what has been found to be good practice.

Several types of troubles should be considered. One is failure of the system to provide the desired heating effect. Another is corrosion or mechanical damage leading to ultimate loss of heating effect. Finally, a system may be a problem job because of its effects on its environment — discoloration, cracking of ceilings and floors, or damage to vegetation. Each system must be considered individually to obtain satisfactory performance and service life. That is, the procedures found acceptable for one system may not be applicable to another because of variations in local conditions.

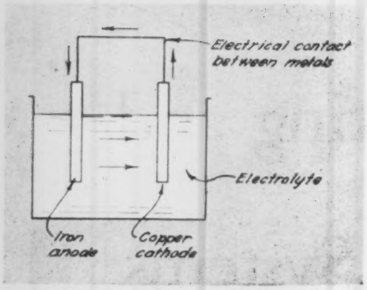
Careful attention must be given to calculating heating requirements and sizing pumps, the piping system, and the boiler or heat exchanger in any system. Much information is available to do this and these important design considerations will not be discussed here. The purpose is to set forth other less obvious design and installation factors.

Radiant heating installations may be made in concrete slabs on grade, in suspended concrete slabs, and in ceilings. Probably most difficulties occur with the slab-on-grade type of installation and this type of installation is stressed here.

Minimizing Corrosion Failures of Piping

Corrosion is the deterioration or destruction of a metal as a result of reaction with its environment. It may take place by any one of several means. It may result from chemical reaction between the pipe and acids or other oxidizing agents in contact with the pipe. Rusting is one example of chemical corrosion.

Corrosion may be the result of a flow of electrical current which is generated by contact of dissimilar metals immersed in an electrolyte. The current generated under these conditions is called a "galvanic current" (named after the man who discovered the effect). This type of corrosion is frequently called galvanic corrosion or electrolysis.



1 THE SIMPLE GALVANIC CELL illustrates the means by which "galvanic" corrosion occurs. Electrical current flows from the anode through the electrolyte to the cathode and then the anode corrodes. In general, metal highest in the "galvanic series", shown in Table 1, will be anodic. Eliminating the electrolyte or breaking the electrical contact between the metals will prevent corrosion

TABLE 1—"GALVANIC SERIES" shows tendency for dissimilar metals in contact to corrode by galvanic action when an electrolyte is present

Corroded end (anodic or least noble)
Magnesium
Aluminum
Zinc
Chromium
Iron
Nickel
Lead
Copper
Silver
Platinum
Gold
Protected end (cathodic or most noble)

A simple galvanic cell is shown in Fig. 1 with electrodes of iron and copper to illustrate the principle of galvanic action. When the electrodes are connected electrically by an external circuit and immersed in an electrolyte, current will flow from the copper to the iron in the external circuit, and from iron to copper through the electrolyte. An electrolyte is a solution such as impure water which will conduct an electric current. The electrode from which current flows into the electrolyte is called the anode (iron in this case). The other electrode is called the cathode. Corrosion normally takes place at the anode in a galvanic cell. Thus, in this case the iron would be destroyed. Corrosion may also take place at the cathode by secondary reactions of the products of the electrolysis with the material of the cathode.

The rate at which current flows in a galvanic cell, and thus, the rate at which the anode is destroyed, depends in part upon the relationship of the metals in the "electrochemical" or "galvanic series." The order of some common materials in the electrochemical series is given in Table 1. In general, when two metals form a galvanic cell, the metal highest in the series will corrode. Thus, iron will corrode when it forms a galvanic cell with copper. The greater the difference between metals in the series, the more rapid will be the corrosion. For example, an iron-copper cell will deteriorate the iron more rapidly than will an iron-lead cell.

Metals above iron in the series may be used to prevent corrosion of iron as they will cause a current to flow to the iron from the electrolyte. This method of protection is termed "cathodic protection" since the protected metal is cathodic with respect to the protecting metal. Magnesium is often used for cathodic protection of underground pipe lines. The metals that are low in the electrochemical series are referred to as noble metals. Thus, silver, platinum, and gold are noble metals.

Corrosion may also occur as a result of leakage of stray currents from power sources through the ground to a metal structure and back to the ground. Corrosion takes place where these stray currents leave the metal structure. This type of corrosion occurs most rapidly when the stray currents originate from d-c power sources. Stray alternating currents do very little damage to the metal. With these few fundamentals of corrosion in mind, examples of failures that have been observed will serve to point out the precautions that should be taken to minimize corrosion difficulties.

Keep Ground Water From Piping

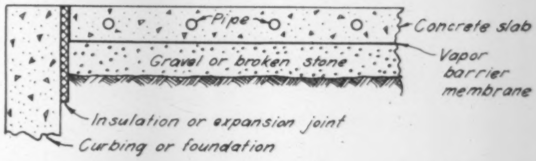
Corrosion of the exterior surfaces of piping by both galvanic and chemical action depends upon water reaching the exterior surface of the pipe. Thus, in slab-on-grade installations the use of a vapor barrier or membrane is advisable. A membrane is a moisture or vapor proof barrier which isolates the slab from seepage of water that can be caused by high water tables or by many other means.

In some areas and situations it may appear that a membrane is not needed. However, the cost of a membrane is small in comparison with the cost of replacing damaged sections of a radiant heating or snow melting system. Since prediction of moisture sources is difficult, the use of a membrane in every slab-on-grade installation should be considered.

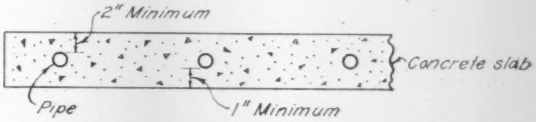
The membrane can either be a composition material, plastic, or asphalt impregnated paper, etc. The membrane should be installed under the slab containing the pipes to assure positive protection of the concrete and piping. The membrane should be installed so as to isolate the piping from insulation or other foreign materials which may cause corrosion. Care should be taken to prevent puncturing of the vapor barrier during placement of piping and concrete and by other trades on the job. It is effective only when it serves continuously as a vapor proof barrier.

The proper location of the membrane when a single concrete slab is placed is shown in Fig. 2. The layer of gravel as shown is also desirable to prevent the rise of ground water to the slab by capillary action. Complete encasement of the piping in concrete is also desirable to minimize corrosion failures.

It is not good practice to rest the piping directly on the membrane because heat will either dry out the membrane or disintegrate the material, which may cause the piping to be exposed. It is recommended that the pipes be supported 1 in. or more off the bottom of the slab as shown in Fig. 3. In this way the piping will be isolated from the membrane and will be encased in concrete. Good practice indicates that the piping should be near the center of the slab.



2 VAPOR BARRIER MEMBRANE beneath concrete slab in which piping system is embedded will keep ground water from piping and minimize corrosion. Membrane should be placed between the insulation or expansion joint and the concrete slab



3 ENCASING PIPING SYSTEM in dense concrete will minimize corrosion. Good practice is to provide for a minimum depth of bury of 2 in. and to provide a minimum of 1 in. between bottom of slab and pipe to insure adequate encasement and freedom from cracking

If two slabs are placed, the first placement is generally made with insulating concrete and the piping should be embedded in the upper slab. Since insulating concrete is not effective when wet, the membrane should be placed between the insulating slab and the gravel base. This will keep the insulating concrete dry. The membrane should be brought up the sides of the slab to form a pan, so no water can seep in between the membrane and the slab. The piping should not be placed at the interface of the two concrete slabs. It should be supported as discussed above to insure that it is encased in the upper slab.

Dry Wells May Cause Failure

In one trouble job studied, a series of dry wells had been dug next to the building to receive the water from the roof. The downspouts were tied directly into these dry wells. The floor slab of the building contained a hot water radiant heating system. There was a black top parking lot adjacent to the building. During several severe storms, it was noted that the wells became filled and the surface water ran directly off the roof, overflowing the gutters. After a period of time, the radiant heating system failed. The cause was attributed to the downspouts being connected to the dry well without a break. This direct connection of the downspouts created a head pressure on the well under the slab of more than 10 psi, forcing the water around the pipe coils, thereby setting up conditions for corrosion. The solution was to install a funnel in the downspout near the slab surface to break the direct connection between the gutters and the dry wells.

Select Fill Materials Carefully

Do not use cinders, salt earth, or any other fill having chemical characteristics that will cause corrosion. Ground water rising through such fill will dissolve some of the material. If this water comes in contact with the piping, corrosion can result. Since it is not always possible to control the nature of the subsoil and fill, the vapor barrier is an effective means of minimizing this type of failure. Complete encasement of the pipe in dense concrete will also minimize corrosion caused by this means.

Proper drainage of the site is also important in minimizing piping failure in slab-on-grade installations. Pockets of water adjacent to foundation walls or snow melting panels may cause seepage of water into the panel. In some cases this seepage may carry salts, and other corrosive materials from the surface to the piping and may cause a corrosive failure.

Piping Should Be Supported Properly

The piping should be well supported during the placement of concrete. This will insure proper and adequate encasement.

In the case of steel or wrought iron pipe, steel wire "bolster-up" chairs or pre-cast concrete supports are recommended as shown in Fig. 4. The use of steel wire chairs for this purpose is one acceptable method for supporting the piping as they are reasonable in cost. Also, it has been observed that where steel bolster-up chairs have been used with ferrous piping and all other precautions have been followed, no failures have occurred.

Concrete supports may be made on the site by placing mounds of concrete under coils temporarily supported by other means. A dense concrete should be used and good contact must be obtained between it and the pipe. The temporary supports should be removed after the concrete supports have set but prior to placing the concrete for the slab.

Copper coils may be supported by stone mounds or cast concrete supports as shown in Fig. 4. In some instances, copper coils are laid on the base material and concrete placed over the coils. After the concrete is placed, the coils are lifted into position in the slab. This practice is not recommended because of possible damage to the coils when lifting them and the uncertainty of pitch and depth of encasement that results.

Do not use wood stripping or other organic materials as pipe supports or let them contact the piping in or under the slab. Also, clay or any other porous bricks should not used as permanent pipe supports in the slab. These materials will absorb moisture and may cause corrosion where contact with the piping is made.

Concrete Should Be Tamped

Frequent reference has been made to encasement of piping in concrete to minimize corrosion. If the concrete is not properly tamped and vibrated around the piping, a void may exist in which air, moisture, and foreign material may collect. Corrosion failures in several types of embedded piping systems have been observed in which corrosion has proceeded[1] along the lower edge of the pipe. Such corrosion begins where foreign materials and entrained water contact the piping. Once a leak develops, fluid travels along the pipe and corrosion spreads to other areas when the piping is not properly encased in dense concrete.

The use of liquid antifreeze solutions should be avoided in concrete or mortar being placed in freezing weather. It should be noted that there is no solution which will significantly lower the freezing point of concrete when added in acceptable concentrations. In one case where snow melting coils were placed under granite stair treads, such a solution was used in the mortar when the treads were set in place. This mortar was therefore in contact with the coil. In two years the pipe failed

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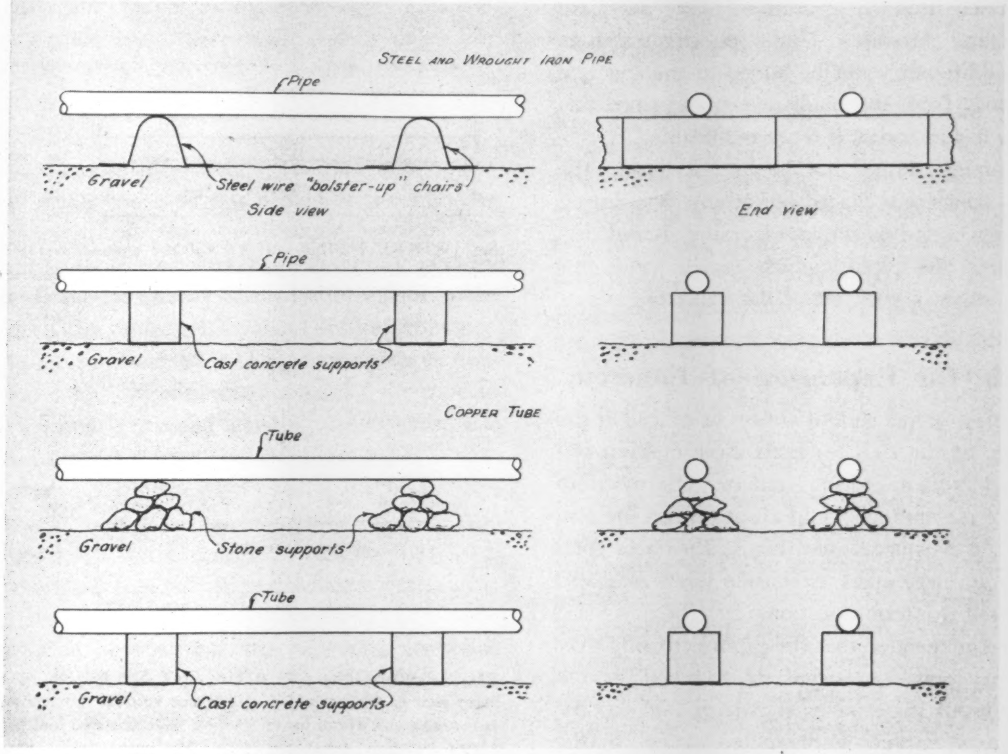
1) *Correspondence with J. R. Boyle, P.E., Boyle Engineering Laboratory*



4 GOOD PRACTICE IN SUPPORTING PIPING during placement of concrete is illustrated here. Use of porous materials to support pipe is not recommended as they may absorb moisture and cause corrosion of pipe at points of contact

because of corrosion. Analysis of the mortar indicated high sulfur content which was attributed to the antifreeze solution. The use of such antifreeze solutions is not considered good practice by concrete authorities. However, adequate site supervision is necessary to prevent poor practices during placement of the concrete.

The use of calcium chloride in concrete for these systems should be consistent with good practice. Calcium chloride is frequently used in concrete to increase the rate of strength gain. The maximum recommended quantity for this purpose is two percent by weight of cement[2]. The amount added to concrete should be carefully controlled. Also, the calcium chloride should be thoroughly mixed to insure[2] proper dispersion through the concrete. Calcium chloride when added as suggested above has had no significant[3] corrosive effects on ordinary reinforcing steel. The increase of electrical conductivity of the water in concrete due to calcium chloride may increase by a small amount any galvanic corrosion[3] when dissimilar metals are in contact in the concrete slab.

The following information (provided by the Portland Cement Association) will be helpful in minimizing corrosion that may be encouraged by poor concreting practices. "The best precaution we know of to minimize corrosion of embedded pipes is to use a high-quality concrete. A mixture containing at least six sacks of cement per cubic yard should normally be watertight enough to prevent progressive corrosion of buried pipes. The use of air entrained concrete would be recommended for most installations, since air entrainment increases durability and reduces permeability. The pipes should be covered by at least 2 in. of concrete. Properly spaced and well-constructed joints are essential, especially in pavements, to prevent cracks which would permit penetration of water into the concrete.

"No special precautions in mixing and placing of concrete beyond normal good practice are required. The concrete must, of course, be thoroughly compacted and cured for at least seven days under normal conditions for adequate strength and durability. Under no circumstances should additional water be added to the concrete as it comes from the ready-mix truck, since this weakens it and makes it more permeable."

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[2] *Correspondence with W. E. Dickinson, Calcium Chloride Institute*
[3] *Correspondence with R. G. Knox, Portland Cement Association*

The piping should not be heated during the time the concrete is placed nor at any time during the curing period to prevent freezing. Rapid drying around the piping which results from this heating causes a poor set of the concrete.

Provide for Expansion of Concrete

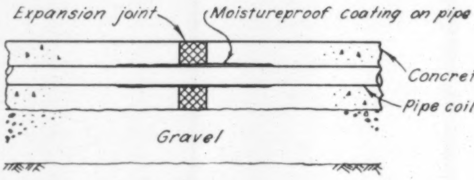
Expansion joints should always be placed at the periphery of the slab for both snow melting systems and radiant heating systems. The moisture barrier or membrane should always be on the slab side of the expansion joint. Fig. 2 illustrates good practice. In large areas, expansion joints may also be required at interior locations.

It is recommended that the piping crossing over expansion joints be coated or wrapped with a moistureproof material as shown in Fig. 5a. Asphalt mastic, asphalt impregnated papers, plastic films, and other similar materials are acceptable for this. The concrete will not adhere to the pipe and will permit it to move within the concrete when expansion takes place. The moisture proofing also minimizes corrosion of the pipe that may be caused by water seeping between the expansion joint and the edge of the slab. Water may arise from floor scrubbing and mopping, snow melting, or other similar sources. A hot mastic poured in the expansion joint will also minimize this water seepage and subsequent corrosion.

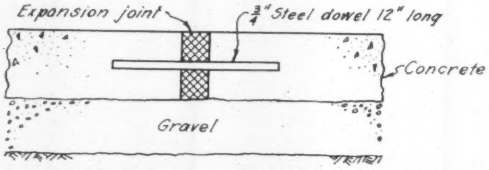
Adequate expansion joints also minimize cracking of the concrete slab. Cracks due to inadequate allowance for expansion permit penetration of surface moisture.

When concrete slabs are subjected to heavy loading, as in roadways or airplane hangars, adjacent sections of the slab should be dowelled to prevent vertical displacement at the joints. This is illustrated in Fig. 5b with a recommended dowel size and spacing. Dowelling maintains the integrity of the expansion joint and prevents mechanical damage of the piping.

Cracking of the surface of a concrete panel is also minimized by proper encasement of the pipe. As shown in Fig. 3, the top surface of the pipe should be at least 2 in. below the panel surface. Greater depth of bury may be considered in heavy slabs.



5a WHERE PIPING MUST CROSS expansion joints it should be wrapped or coated with moistureproof material to prevent seepage of moisture to the pipe or tube surface



5b DOWELLING OF ADJACENT SECTIONS of concrete slab is recommended to prevent vertical movement between sections where heavy loading is anticipated and piping passes through expansion joint. Minimum dowel spacing should be 12 in. on center and provision should be made for expansion of dowel

Avoid Contact of Dissimilar Metals

Failures have occurred because of contact between dissimilar metals in the presence of an electrolyte such as water. Under these conditions a galvanic action develops that may corrode the pipe if it is higher in the electrochemical series. With this type of corrosion, the pipe will often show an almost round hole about ⅛ in. diameter just as though a drill had been used. Examples of this type of corrosion are shown in Fig. 6. In the case of the brass body valve and iron pipe, pitting due to galvanic action caused the characteristic small diameter hole. This assembly was located in an expansion joint and the necessary water (electrolyte) to complete the galvanic cell seeped between the joint and concrete.

The interior surfaces of this same assembly also showed evidence of galvanic action. The pipe surface was coated with rust. In this case, the circulating fluid served as the electrolyte. This corrosion could have been minimized by using like materials in the valve and pipe, or by using an insulating or dielectric bushing between the pipe and valve.

Another corrosion failure has been observed in a job where the pipe was placed at the interface of two concrete slabs of different compositions. When water seeped into the joint through the interface, the pipe corroded and failed. Subsequent study of the materials involved showed that galvanic action could occur. This further emphasizes the need for complete encasement of the pipe in the upper slab, thereby avoiding the effect of different concrete mixes.

Some of the metal combinations that have been observed to cause failures in these systems include ferrous pipe in contact with exposed copper wiring for electrical grounds, copper water pipes in contact with steel reinforcement in slabs which rest directly on ferrous pipe coils, and brass stripping which touches the steel reinforcing rods in contact with the piping.

6 GALVANIC CORROSION of ferrous piping removed from embedded systems is shown here. The bronze valve shown at right in photo was installed in an expansion joint. Seepage of water through joint completed galvanic cell and pipe corroded. Corrosion also occurred internally in this sample. Other samples were clean on interior and corrosion occurred only on exterior

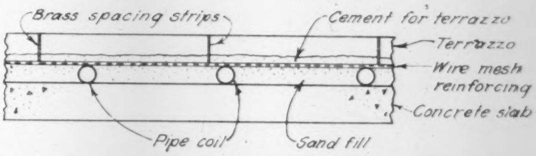
Galvanic Corrosion in Suspended Slabs

Pipe failures in suspended floor and ceiling slabs may be caused by the piping coming in contact with dissimilar metals which cause galvanic action to be started. Eventually — and in some cases, in relatively short periods of time — the piping is damaged and leaks result. So long as the material encasing the pipe remains dry, galvanic action will not occur. However, water from mopping and other sources may reach the piping through cracks and start the corrosion process.

This type of failure has been found to occur where terrazzo floors are used. The following reason has been discovered in investigating several failures. In this type of floor construction, as shown in Fig. 7, reinforcing mesh is laid on top of piping which is buried in a layer of sand. The reinforcing mesh also extends through the slab to contact the brass spacing strips used in making terrazzo blocks. Galvanic action results when water seeps into the floor. Corrosion may also begin because of residual moisture in the sand and it is recommended that kiln dry sand be used.

When it is necessary to use dissimilar metals, as in this case, it is advisable to coat the more noble metal with an electrical insulation or to insulate them from each other with plastic materials, bituminous coating materials, or other mastics.

Most installations have been abandoned where such failures have occurred. However, in one large job when such a condition was thought to be developing, a rectifier was installed to counter the



7 CORROSION OF PIPING embedded in terrazzo floor construction as shown here may occur if water seeps into subfloor to complete galvanic cell consisting of brass spacing strips in contact with wire reinforcing mesh and ferrous piping. Placing electrical insulation between brass and ferrous components will eliminate this type of corrosion galvanic currents, and the installation was saved. By means of a rectifier, which converts alternating to direct current, a current can be imposed to buck the galvanic current. In general, this should be done at an early date by a person well qualified in corrosion control.

Welded Joints May Corrode

Braze welding of ferrous pipe with brass brazing materials may cause galvanic action to start. This can occur on the fluid side of the joint as well as on the exterior. Many weld materials are available that are suitable for this service. Those selected should be near the piping material in the electromotive series.

It should be noted that a steel weld on steel pipe can fail under certain conditions because of galvanic corrosion. The weld metal is usually a purer form of steel than the external surface of the pipe. The dissimilarity may be sufficient to set up a small galvanic action which attacks the weld. For this reason, some engineers[1] recommend a coat of pitch on all welds made on underground piping.

If the piping system is properly protected from moisture, pitching of the joints is probably not essential. However, where piping is not protected, coating of the weld may be economically advantageous.

One other precaution that should be observed to prevent corrosion of piping joints is to thoroughly clean any flux from the joints. Many fluxes have acid properties and may cause corrosion and failure at the joint. If a small leak begins at the joint, conditions are established for corrosion to proceed along the exterior of the pipe.

Watch for Stray Currents

For any installations near electrified railroads or other electrical installations where high d-c voltages are encountered, the radiant heating or snow melting system should be tested for stray currents and potential before heat is applied. This will serve as a precaution to be sure that stray currents do not cause electrolysis of the system through leakage into the earth, high water table, or through water mains. In stray current corrosion, the metal is depleted where the current leaves the metal and passes to ground. If good electrical contact exists along the length of the pipe, electrolysis will be general and proceed slowly. If contact is intermittent, pitting may result and failure may occur more rapidly.

Cathodic protection of the piping system may be used to prevent failures of this type. Cathodic protection is achieved by burying a material near the piping system that, when connected by an electrical circuit to the piping, will cause a current to flow to the piping. The anode must be selected to provide ample current to offset the stray current flowing from the piping. In time, the anode will require replacement since it rather than the piping will corrode.

Check the Electrical System Ground

Grounding the electrical system to the radiant heating system is not recommended, especially where there is a well with a pump on the property. If the electrical system is grounded to the water piping, it is recommended that an electrical insulator be added between the radiant heating system and the water piping. This insulator should be installed on the water line leading to the heating system.

Care should be taken where plastic pipe is used from the pump to the well to make sure that no grounds are attached to the water piping. This will eliminate what might be a serious electrical hazard. Care should be taken to be sure no ground is connected to any piping leading to the radiant heating system. It is recommended that the electrical system always be grounded to a separate pipe or stake buried for this purpose.

Although a-c current causes a very small amount of stray current electrolysis, some failures in part due to this cause have been observed. Grounding the electrical system through the piping establishes the necessary conditions for this failure. Some engineers specify electrical insulators at all connections to the headers as a precaution to prevent failure of embedded piping by this means.

Antifreeze Heat Transfer Solutions

Oil and ethylene glycol are the two most popular methods of protecting the snow melting system against freeze-up when not in operation. Since these two fluids are different they are discussed separately.

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[1] *Correspondence with J. R. Boyle, P.E., Boyle Engineering Laboratory*

Corrosion inhibitors are recommended in systems containing ethylene glycol* and water and are usually supplied in the ethylene glycol based antifreeze to overcome the corrosive action of water. Although ethylene glycol based antifreeze is not initially corrosive, it can break down in service usage under some conditions and must be suitably inhibited for use in snow melting systems. The change in corrosive character is due to the depletion of inhibitors which provide reserve alkalinity to neutralize contamination and maintain the solution in the desired pH range. Contamination and depletion of the inhibitors may be caused by a number of things, some of which are as follows:

1) Products of corrosion — these are slightly acid in nature.
2) Aeration of the solution.
3) Rust in the system — this may be pre-rusting of ferrous pipe during storage or rusting caused by hydrostatic pressure testing with water.
4) Stop leak compounds.
5) Decomposition of the ethylene glycol base — oxidation of the base material may be accelerated by temperature and ample heat exchanger design is necessary to maintain acceptable temperatures. One suggestion is that heat exchanger surface temperatures in contact with the solution be maintained below 300 F.
6) Mixing of different formulations of antifreeze — in general, nationally marketed formulations contain compatible inhibitors but in automotive service, mixing usually voids the guarantee.

Since so many factors affect the rate at which inhibitors are depleted, there is no way in which to predict service life. Anything that can be done to minimize contamination will increase service life. Thus, every system should be thoroughly flushed out prior to installing the antifreeze to eliminate any contaminants resulting from assembly of the coils. Residual contaminants may cause rapid depletion of the inhibitors and shorten service life of the antifreeze.

Add Inhibitors Only When Necessary

Inhibitors should be added to the solution only when recommended by the supplier and when the chemical analysis or visual inspection indicates that the original inhibitors have been depleted. If water treatment service is available, the chemical and physical properties of the solution can be checked on a routine basis. There is general agreement that detecting depletion of the inhibitors in ferrous piping systems by observing the general condition of the antifreeze is as effective as chemical analysis. When the inhibitors have been depleted, the solution will generally become brown or rusty in color. When this occurs a complete change of solution or addition of inhibitors is indicated. A visual inspection port in the system for observing these changes may prove helpful.

If inhibitors are added to a solution they should be the same as those originally contained in the formulation. As indicated earlier, not all inhibitors are compatible and when incompatible inhibitors are mixed, the reaction may neutralize the effect of either one or both. While inhibitors may be added with some degree of success, adequate corrosion protection will not be obtained by field addition of inhibitors. Thus, it is recommended that the system be drained and that the contaminated solution be replaced.

Depletion of the inhibitor in a snow melting system indicates that a source of contamination probably exists. Prior to installation of the new solution, every effort should be made to eliminate the contamination. This will result in longer service life of the new solution and will eliminate a possible corrosion failure of the system.

It should be noted that some inhibitors used in commercial antifreeze solutions are ineffective at low temperatures, especially with zinc or galvanized iron. Since a snow melting system is often idle at very low temperatures, galvanized pipe and fittings should never be used in these systems.

Oil is not corrosive but it does oxidize and form sludge when in contact with copper. The copper acts as a catalyst for this oxidation process so heat transfer oil should not be used in snow melting systems employing brass or copper components. Further discussion of other properties of aqueous glycol solutions and heat transfer oils may be found later in this report.

**Information on this subject has been based upon correspondence from* the following:

1) R. C. Carr, Olin Mathieson Chemical Corp.
2) F. G. Church, National Carbon Co., Div. of Union Carbide Corp.
3) J. C. Crawford, Commercial Solvents Corp.

How to Prevent Loss of Heating Effect

Carefully designed radiant heating or snow melting systems may fail to provide the necessary heating effect when installed. Such failures may result from improper venting, neglecting to balance the system when placed in operation, or poor fabricating techniques. A few suggestions based upon on-the-job experience should prove helpful in minimizing such failures.

Adequate Venting Is Important

Venting is a very important part of the design. Experiences have indicated that not enough vents are installed. In starting up any radiant heating or snow melting system, one of the problems is to get all the air out of the system. The designer should take all precautions to be sure that the system has ample vents at the proper points.

Two methods of venting coils located above the boiler and headers that have been used with success are shown in Fig. 8. When there is no concern about openings in the floor surface, the vents may be placed on top of the coil as shown on right. When for reasons of appearance no openings are permitted in the panel surface, adequate venting may be obtained by the method shown on left. The ⅛ in. pipe in this case is run through the same sleeve as the coil to a place where the vent is accessible.

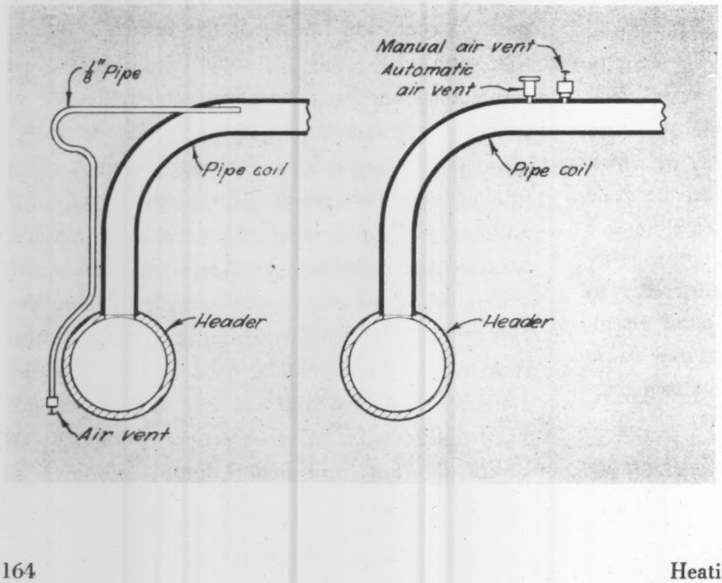
Care should be taken to pitch piping properly for adequate venting and for draining the system. Wherever there is a change of elevation in the slab, grid coils are the best suited for proper installation providing that the header of the grid is at the highest point. Serpentine coils will provide the best service where the area is level.

Some other points to remember to obtain adequate venting and to prevent air from entering the system are:

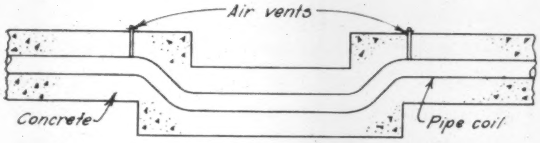
1) Always install an automatic air vent at the highest point of the system.

2) Always place a mechanical air vent adjacent to the automatic vent at the high point. This permits periodic checking of the performance of the automatic vent.

3) Watch for changes in elevation that may



8 TWO METHODS OF VENTING coils located above boiler and header are shown here. Method on left may be used when no openings for vents may be made in the floor surface. Method on right is used where vent may be placed in floor surface. At the highest point of the system, a manual vent should be placed adjacent to the automatic vent to permit periodic checking of the performance of the automatic vent



9 WHEN ELEVATION OF PIPING changes to follow structural changes, vents must be placed at high points as shown here to properly vent coil

result in two possible air traps in a coil. A vent should be placed at each side of the change in elevation as shown in Fig. 9.

4) Use a surge chamber when venting at points of high velocity.

5) Select circulating pumps with adequate seals on the suction side to prevent air from entering the system at this point.

System Must Be Balanced

For satisfactory operation, a system must be balanced after installation. The designing engineer should provide enough balancing cocks to permit easy and satisfactory balancing. The most efficient systems have balancing cocks on each coil or on each area of coils and are properly vented. It has been found that locating the cocks on the return line downstream from the air vent may be of help in proper venting of the coils.

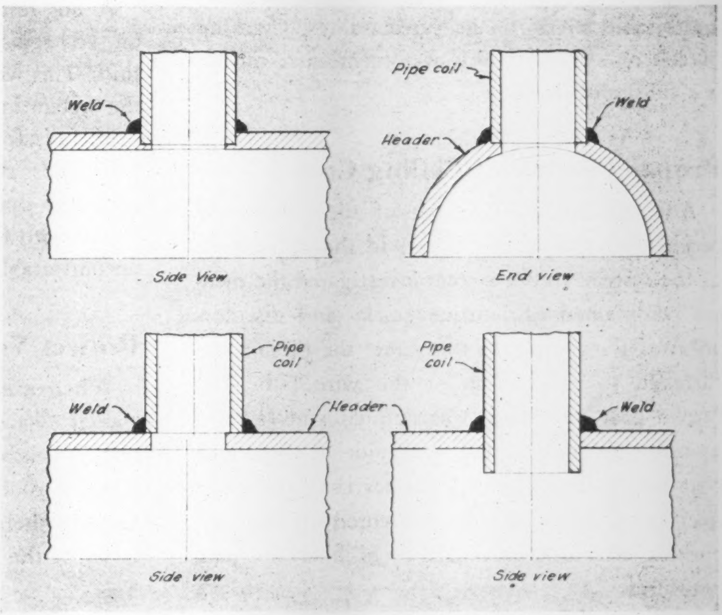
Each large installation should be provided with a portable potentiometer and thermocouple. It is recommended that the consulting engineer specify that a portable potentiometer and thermocouple be supplied for an initial balancing by the contractor. It should be further specified that the instrument be left on the job for the plant or building engineer to check the installation periodically.

Fabricate Coils Carefully

All steel or wrought iron pipe 2 in. diameter or less should be acetylene gas welded. All joints in the slab should be welded as there must be complete assurance of no leakage and minimum pressure loss. All copper pipe joints in the concrete slab must be brazed and soft solder should be avoided. However, soft solder is acceptable for joining copper pipe in ceiling coils when service temperature is low. The stress imposed upon the joints by expansion in ceiling construction is much less than that imposed in concrete slabs. Whereas concrete is hard, ceiling construction is usually soft and the material surrounding the joints fails before the loading causes failure at the joint.

Good practice is to bend pipe so that the radius of bend is five times the inside diameter with a minimum of three times the inside diameter. This applies to pipe diameters up to 6 in.

10 GOOD PRACTICE of joining coil and header is illustrated at top of figure. The methods of joining the coil and header shown at bottom should be avoided to minimize pipe friction loss



It is good practice to drill all headers for grid coils with a drill the same size as the inside diameter of the pipe. It is then recommended that a recess be cut into the pipe equal to the outside diameter of the pipe and about 1/8 in. deep into the header so that the small size pipe will fit into the recess for welding. This is illustrated in Fig. 10. In order to do this, the header diameter must be approximately one and one-half times the diameter of the coil. Two other methods of joining grid coils to the headers are shown in Fig. 10. These should be avoided whenever possible because of increased pressure loss when joints are not carefully made.

It is recommended that a ball test be applied to serpentine coils by passing a steel ball, with a diameter 1/8 in. less than the inside diameter of the pipe, through the coils with an air pressure of about 5 psi or more forcing the ball through the pipe. The ball test will check ID clearance and discover any projections which may interfere with the flow. It will also indicate any flat bends or other irregularities in the pipe.

The system should be tested for leaks after installation. A small leak at a joint, which itself may go unnoticed, can lead to complete failure of the system. The fluid seeping along the pipe, as noted earlier, can cause corrosion of the exterior surface of the pipe and total failure. The system should be subjected to a pressure of approximately 100 psi until all joints and connections have been checked. Rapping the assembly with light hammer blows will help discover weak areas in the pipe. If oil is to be used in a snow melting system, this test should be made with air or other gases. Water should not be used in this case because of the difficulty in drying the piping prior to filling the system with oil. Any water that remains in the piping may collect at low points and damage the coil when exposed to freezing temperatures, or it may block a section of the coil.

Other Points to Consider

In some cases, a radiant heating or snow melting system may be considered to fail because of undesirable effects on its surroundings. Cracking of concrete floors, which was mentioned earlier, is a failure of this type.

Proper Coating of Ceiling Coils

Adequate plaster coverage of the piping embedded in ceilings is essential to the appearance of the system. In one system investigated the owners complained of hairline cracks and discoloration of the ceiling. In this panel the piping was fastened to the bottom of the wire lath. The brown coat of plaster was applied and levelled by using the pipe surface as a guide. A thin finish coat was then applied. A thicker coat of plaster over the coils would have prevented the cracking and the discoloration caused by high surface temperatures.

Check Valve in Make-up Water Line

A non-return check valve should be installed on all radiant heating system make-up water lines. This will prevent back flow and drainage of the system in the event the water pressure at the main fails for some reason. In one case, a system was almost completely drained but the boiler continued to operate. Steam generated in the boiler flowed into the panels. Damage of floor tile and uncomfortable conditions resulted.

Protect Vegetation Near Snow Melters

When a sidewalk snow melting system is installed adjacent to trees, shrubs or other vegetation, it is advisable to place waterproof insulation between roots and concrete slab as shown in Fig. 11. This helps to prevent premature growth activity of the vegetation that could result in damage.

TABLE 2—FREEZING PROTECTION TEMPERATURE and specific gravity at various temperatures of aqueous solutions of ethylene glycol antifreeze

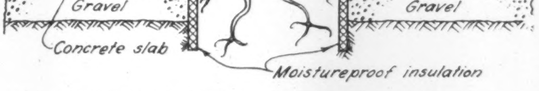
Freezing protection temperature, F	Percent[1] of ethylene glycol by volume	Specific gravity[1] at solution temperature referred to standard temperature of 60 F						
		60	80	100	120	140	160	180
20	15.8	1.028	1.023	1.019	1.013	1.008	1.001	0.995
10	25.3	1.041	1.036	1.030	1.025	1.020	1.013	1.007
0	32.8	1.052	1.047	1.040	1.035	1.030	1.022	1.016
−10	38.8	1.061	1.056	1.049	1.043	1.037	1.030	1.023
−20	44.0	1.068	1.063	1.056	1.050	1.043	1.036	1.029
−30	48.2	1.074	1.069	1.061	1.055	1.049	1.041	1.034
−40	52.3	1.080	1.074	1.066	1.060	1.053	1.045	1.038

[1] *Data supplied by two manufacturers of automotive ethylene glycol antifreeze*

Check Freezing Point Of Antifreeze

When aqueous solutions of ethylene glycol are used in snow melting systems, the freezing protection temperature of the solution should be checked periodically. This may be done by means of a calibrated hydrometer-thermometer field tester. The tester used should conform to ASTM specification D1124. Freezing protection temperatures and specific gravity of the aqueous solution at various fluid temperatures are given in Table 2. The data given in the table represents average values for two antifreeze solutions. Corresponding values for other formulations will deviate slightly from the tabulated values because of difference in inhibitors. Both specific gravity and fluid temperature must be obtained when checking freezing protection temperature to compensate for expansion of the fluid due to difference of fluid temperature and the standard reference temperature of 60 F.

The tabulated data may also be used to determine the amount of antifreeze required for a given freezing point protection. Knowing the local minimum temperature, the percent ethylene glycol antifreeze by volume for adequate protection may be obtained from the table.



11 **VEGETATION ROOT SYSTEMS** near sidewalk snow melting systems should be enclosed with moistureproof insulation as shown here to prevent damage

Open Expansion System Desirable

An open expansion system is desirable and considered good practice whenever it is physically possible to account for expansion by this means. A sight glass may be installed to permit periodic checking of the fluid level and fluid may be replaced without mechanical means. In a closed system, make-up solution must be pumped in.

Both heat transfer oils and ethylene glycols expand when heated to a greater extent than water. This may be seen by comparing the percent change of volume for glycol solutions in Table 3 and that for oil in Table 4 with expansion values for water listed at the bottom of Table 3. The expansion rate with oil and concentrations of glycol normally used may be as much as twice as

TABLE 3—VOLUME OF AQUEOUS SOLUTIONS of ethylene glycol antifreeze increases with increased solution temperature as shown here referred to volume at 32 F

Freezing protection temperature, F	Percent[1] increase in volume with temperature rise from 32 F to temperature specified						
	0	80	100	120	140	160	180
20		0.8	1.2	1.7	2.3	2.9	3.7
0	−0.4	1.1	1.7	2.3	2.9	3.7	4.4
−20	−0.6	1.2	1.8	2.6	3.3	4.0	4.8
−30	−0.7	1.3	1.9	2.7	3.4	4.2	5.0
−60	−0.7	1.4	2.1	2.8	3.5	4.4	5.2
Water (no glycol)		0.4	0.7	1.1	1.7	2.3	3.1

[1] *Data provided for "Prestone" by National Carbon Co., Div. of Union Carbide Corp. Negative numbers indicate decrease of volume from that at 32 F.*

TABLE 4—VOLUME OF LIGHT HEAT TRANSFER OIL increases[1] with increased temperature as shown here referred to volume at 32 F

Oil temperature, F	Percent change in volume
0	1.0 decrease
80	1.8 increase
100	2.5 "
120	3.2 "
140	4.0 "
160	4.8 "
180	5.5 "
200	6.4 "

[1] *Data for Socony Mobil light heat transfer oil*

great as that for water. Failure to consider this in designing the expansion system would result in an undersized expansion tank. Both contraction and expansion of the fluid from normal temperature conditions must be considered.

When using open expansion systems with heat transfer oil, the line connecting the piping to the tank should be sized to prevent circulation of hot oil to the tank. Exposing hot oil to air may result in oxidation and sludging of the oil. Locating the expansion tank at some distance from the boiler to prevent heating of the oil in the tank by extraneous heat gains should also be considered. The expansion tank should be designed to minimize aeration of the fluid when either oil or glycol solutions are used.

Consider Other Fluid Properties

Drinking of ethylene glycol solutions may be harmful or fatal. Thus, no permanent connection should be made between the snow melting system and drinking water supply piping.

In design and selection of heat transfer equipment, the differences in specific heats and viscosities of the various fluids should be considered. With antifreeze solution in the exchanger, the heat transfer rate of a solution protecting to −34 F will be about one-half that for the water. With weaker solutions, the heat transfer rate will approach that of water. With heat transfer oil, the heat transfer rate will be as low as one-fourth that of water. Adequate heat transfer surface should be provided to maintain fluid temperatures at reasonable minimum values to prevent oxidation in the case of oil and depletion of inhibitors in the case of glycol solutions.

Specific heat, specific gravity, and viscosity must be considered in the design of the piping system and selection of pumps. The specific heats of oil and ethylene glycol solutions are less than that of water so that a greater volume of fluid must be circulated for a given heating capacity. Viscosities are greater than that of water, so friction losses are higher. Collectively these properties influence piping design and pumping capacity. Pumps should be selected carefully to meet changing conditions of temperature and viscosity.

[The editors wish to acknowledge the assistance provided in assembling the information for this report from those whose comments are quoted in the text and to many others who reviewed the manuscript.]

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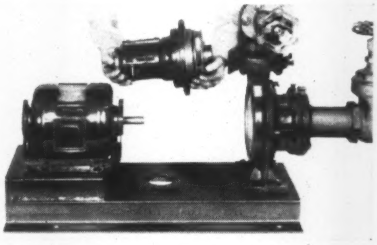

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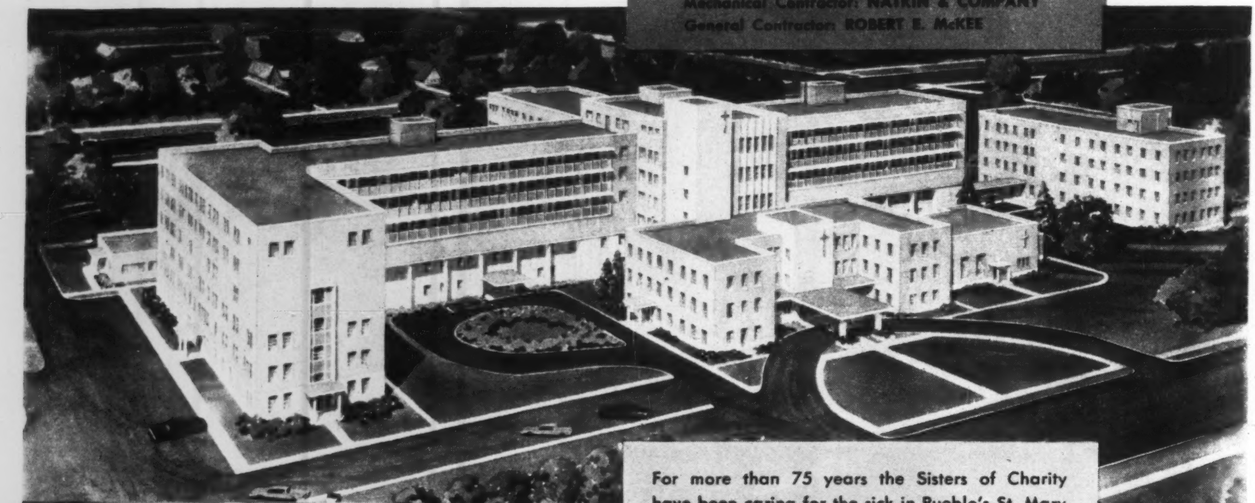

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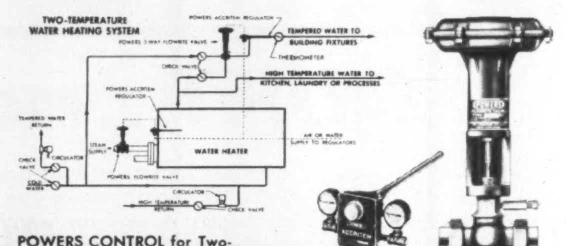
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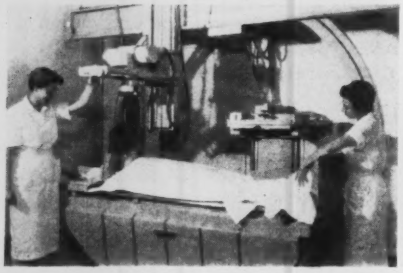

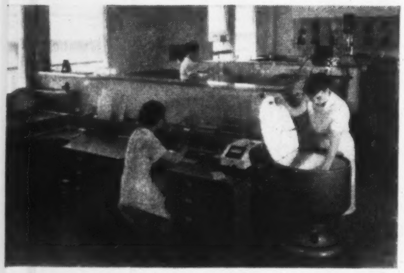

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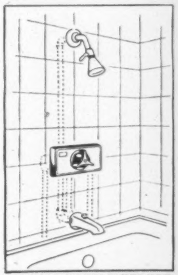

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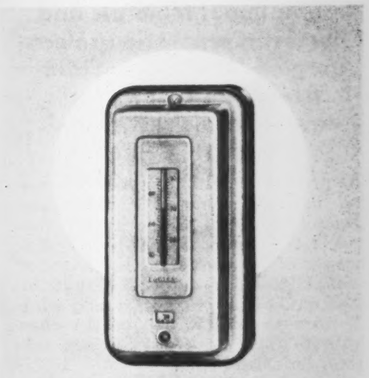

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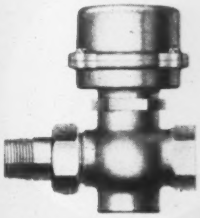

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International Minerals and Chemical Corporation selects Burgess-Manning Radiant Acoustical Ceiling for new Administrative and Research Center

The group of buildings recently occupied by International Minerals and Chemical Corp. in Skokie, Illinois represents 15 years of careful planning. It consists of six connected buildings, of modern design and construction, located on a broad plaza adjoining a forest preserve and is one of the show places of this Northwest Chicago suburban industrial area.

Designed by Perkins and Will of Chicago, for maximum employee comfort as well as operating efficiency, the buildings are comfort conditioned with Burgess-Manning Radiant Acoustical Ceilings. Utilizing radiant energy from the ceiling for heating purposes, all convection type radiators are eliminated from the curtain perimeter walls.

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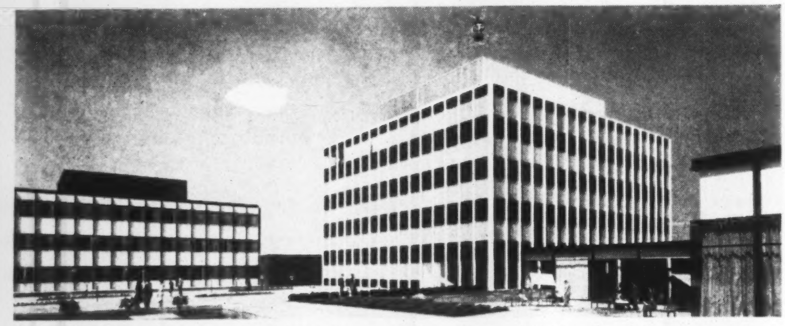

New administrative and research center of the International Minerals and Chemical Corporation at Skokie, Illinois.

A typical view showing the Burgess-Manning Radiant Acoustical Ceiling installed in a general office area.

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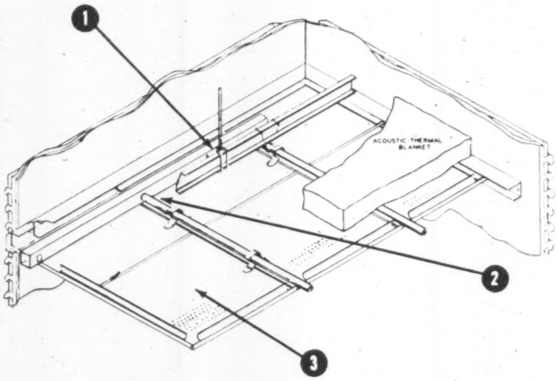

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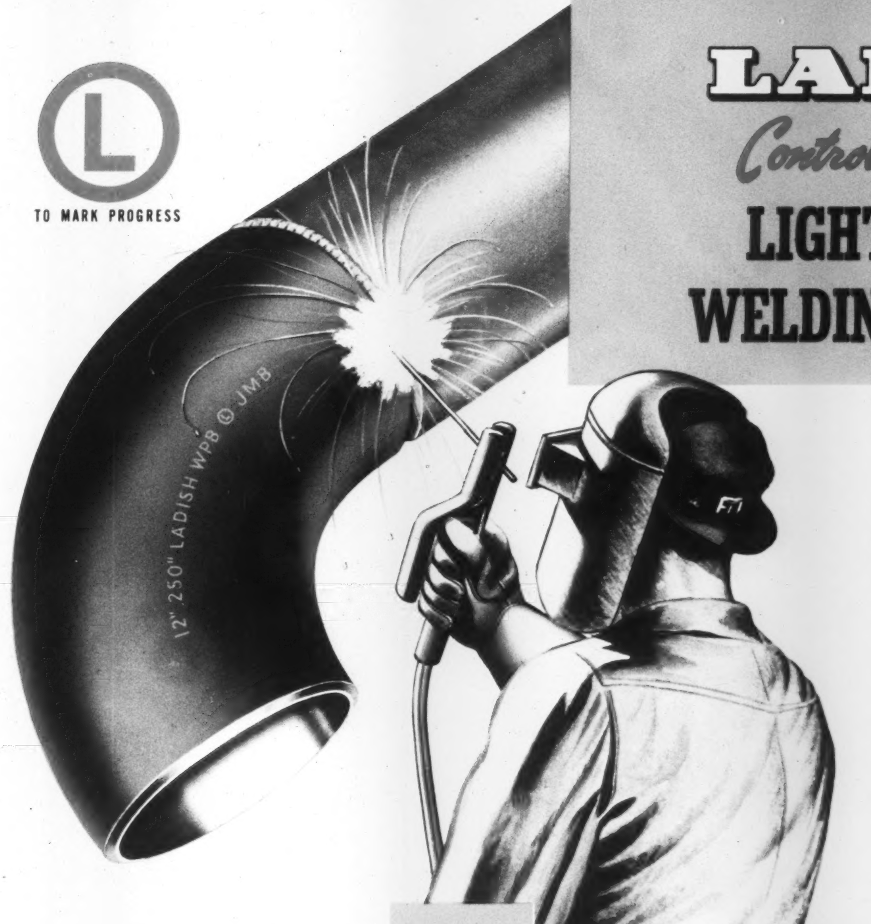

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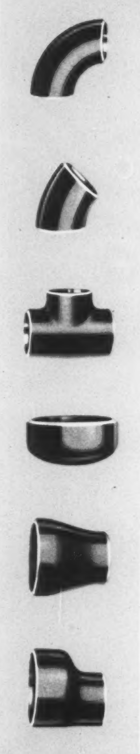

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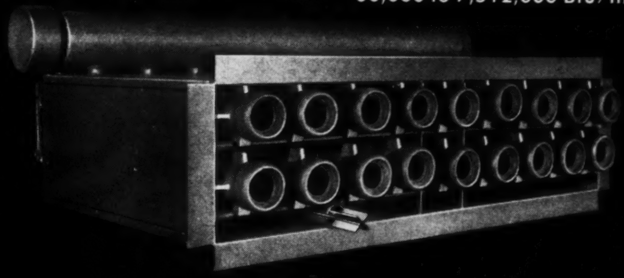

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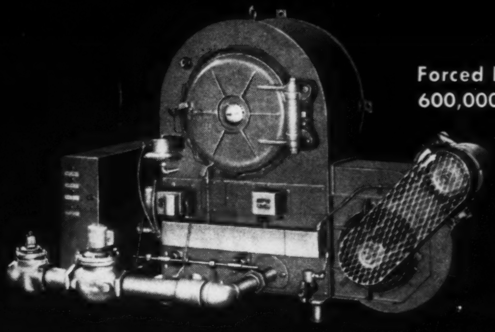

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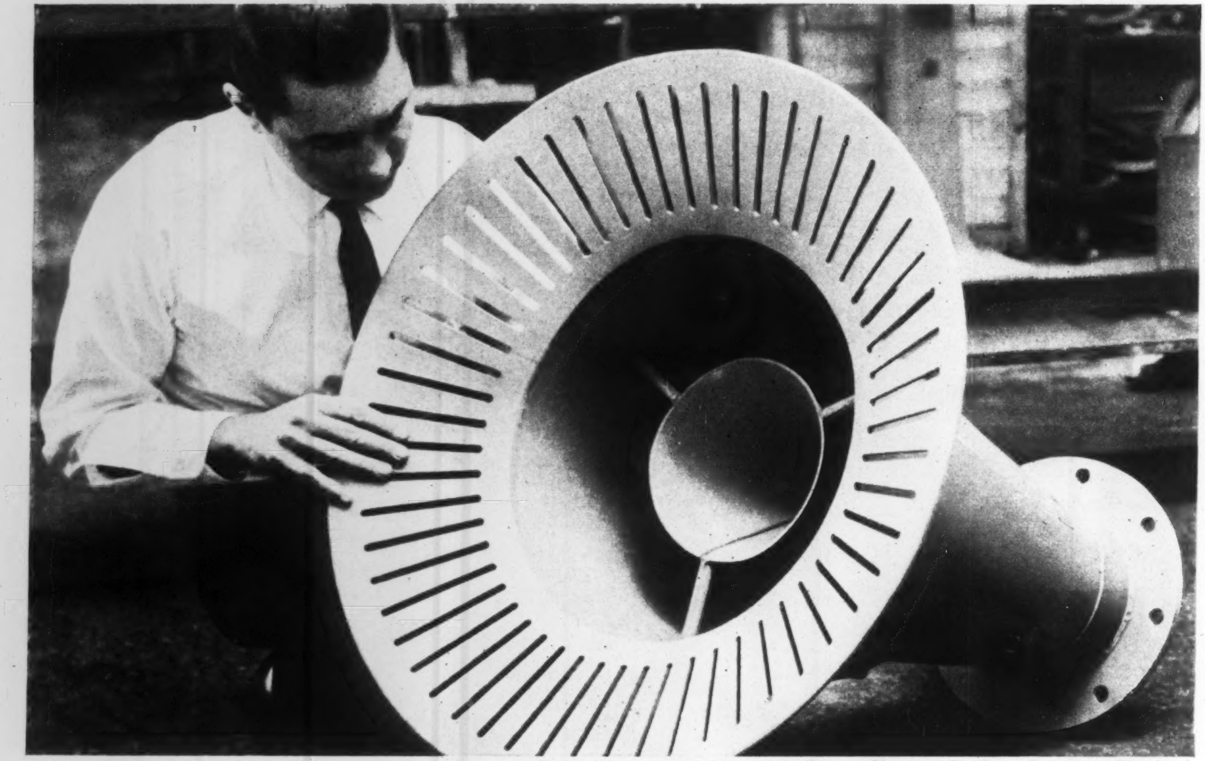

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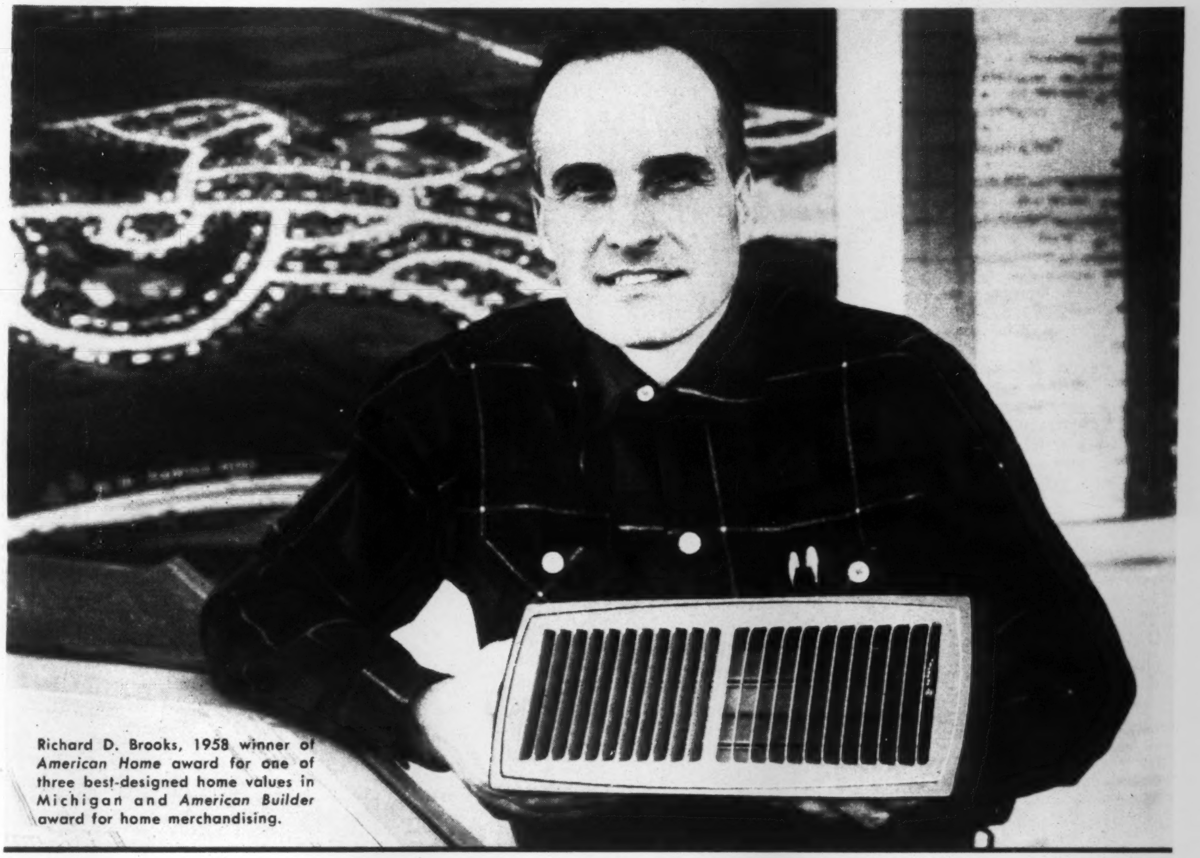

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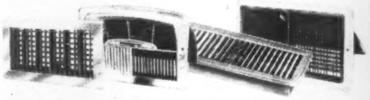

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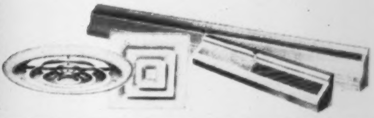
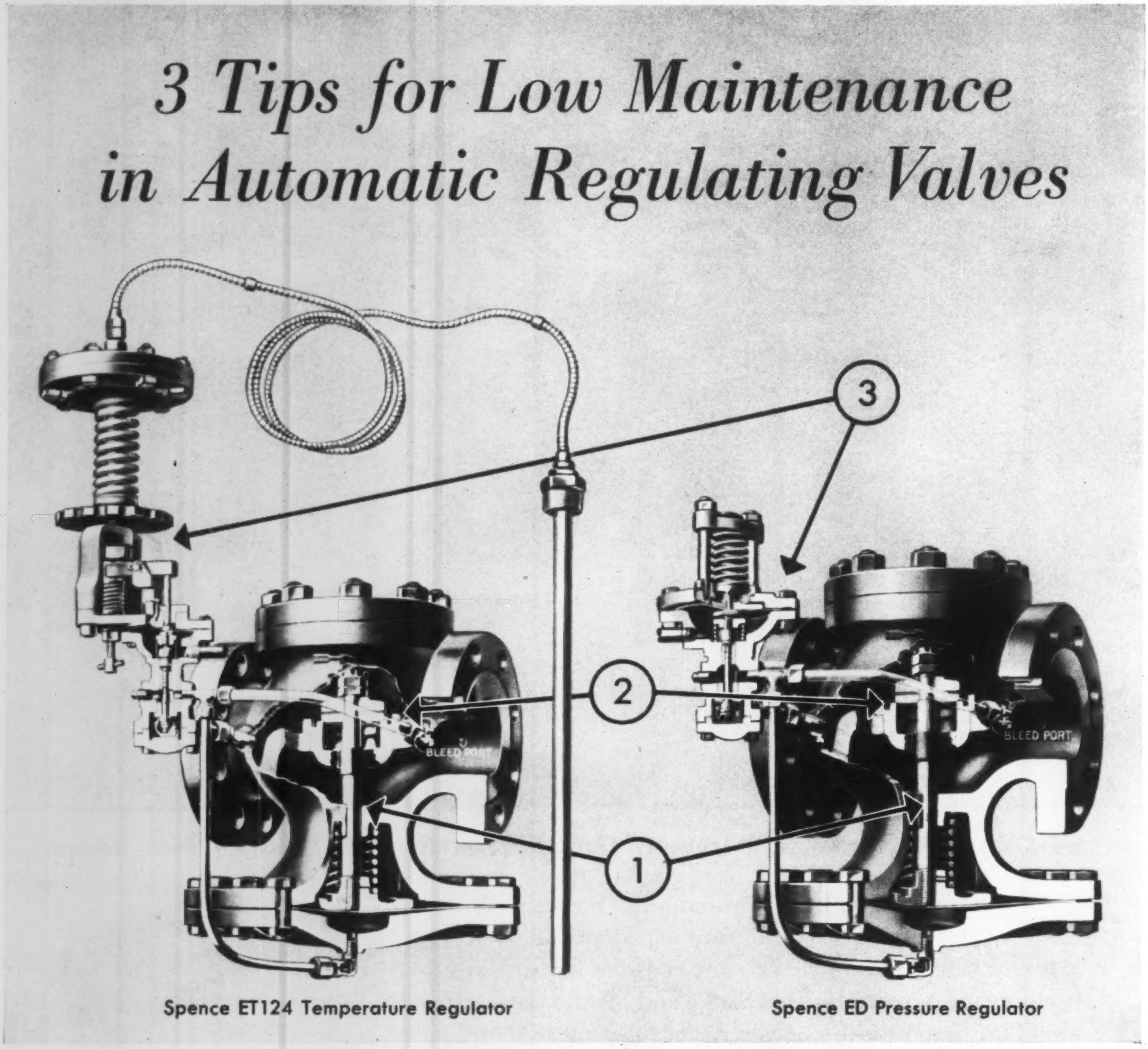


VALVE TIPS:

3 Tips for Low Maintenance in Automatic Regulating Valves



Spence ET124 Temperature Regulator **Spence ED Pressure Regulator**

No engineer has to be told that downtime of regulating valves is costly—and a nuisance.

Nowadays the men who keep these valves operating want to make sure they aren't stuck with a maintenance headache for the life of their valves. That's why we are outlining this simple check list which covers three important features which keep maintenance costs down.

1. Stuffing boxes are probably the number one time consumer in valve maintenance. No matter how you figure it, repacking stuffing boxes is costly.

That's one reason Spence uses a "balanced" diaphragm construction which eliminates stuffing boxes. Simple stem guiding and large metal diaphragm operation reduce sticking and binding to a minimum.

2. Another problem is replacement of seats and discs when they've been cut by steam. Today you can forget about this problem entirely by insisting on an unconditional guarantee against wire-drawing. Spence, for instance, uses SECO Metal seats and discs and gives such a guarantee.

3. Any valve designed to control temperature and pressure within tight limits can be affected by dirt in the steam lines. You can't get a guarantee against this, but you can specify a valve that makes trouble shooting easy. Here's the tip:

Make sure your regulating valve is controlled by an external pilot. If trouble develops, it is easy to find out if it is in the pilot or the main valve with a simple test.

If the trouble is in the pilot, you can remove it without taking the main valve out of the line.

The quickest way to get the regulator working again is to install a spare pilot. This is easy—and in the Spence design it is not expensive to carry spare pilots. Spence pilots fit all sizes of Spence main valves.

These maintenance advantages plus other advanced features are available in a wide range of Spence automatic regulating valves. For more information write for the Bulletin TE.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

SE-144

HUSKY

150-LB. WELDING FITTINGS

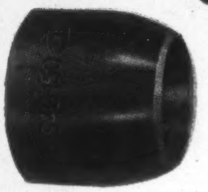
HAVE

TWICE THE STRENGTH
...TWICE THE LIFE!

Straight Tees — No. 211
2″ through 6″

Reducing Tees — No. 211R
2″ x 2″ x 3/4″ through
6″ x 6″ x 5″

90° Elbows — No. 207
2″ through 6″



Reducers — No. 201
2″ x 1-1/4″
through 6″ x 5″

45° Elbows — No. 206
2″ through 6″

STEEL

HUSKY SYSTEMS ARE STRONGER — because nothing is cut away from the pipe to form threads. This means that Husky fittings provide a "double strength" system without weak links at each fitting joint.

HUSKY SYSTEMS ARE COMPETITIVE In nearly every instance Husky welding fitting installations cost the same (or less) than those using threaded fittings because of time saved in joining.

HUSKY IS THE FIRST! There are no other fittings on the market specifically designed to weld normal 150 lb. steel piping systems.

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National Plumbing —
Heating — Cooling Exposition
May 31 — June 3
Miami Beach, Florida
BOOTH 320

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NIBCO INC., Dept. J-6403, Elkhart, Indiana
Please send your new Husky Catalog H-1 without cost or obligation.

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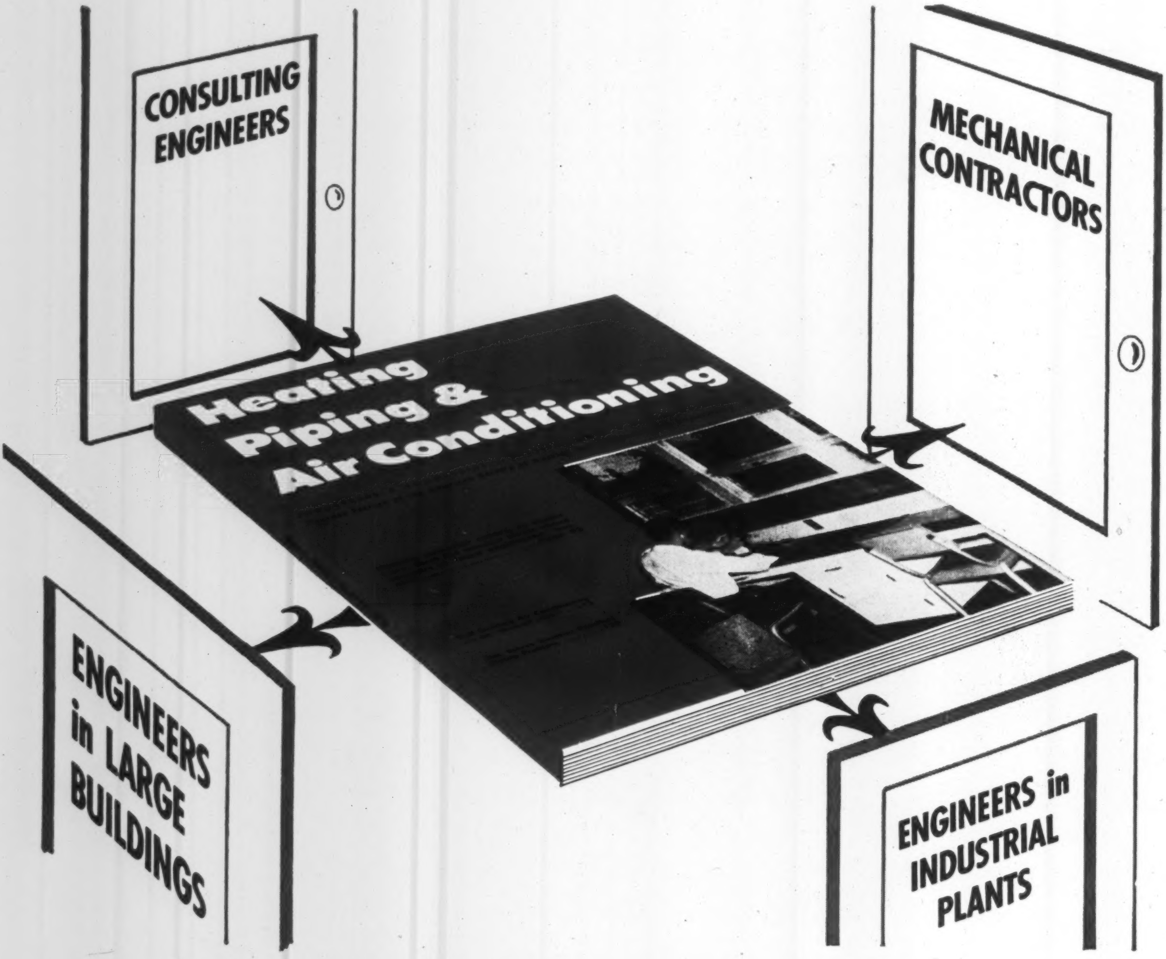
☐ Please also send address of nearest supplier.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MECHANICAL CONTRACTORS
Heating Piping & Air Conditioning
ENGINEERS in LARGE BUILDINGS
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Are you getting through to them? Impressively? Often enough? Your most economical way is to advertise in Heating, Piping & Air Conditioning.

Here's the publication that has as *paid* readers the factors who collectively purchase-control every job in the industrial-large building field.

How do these engineers and contractors regard HP&AC? The provable answer is this: HP&AC has the largest and only fully paid circulation in its field.

How do manufacturers in your field rate HP&AC? Again, the answer is provable: HP&AC leads by over 2 to 1 in advertising volume, has more advertisers, and is used exclusively by more advertisers.

Complete information by return mail!

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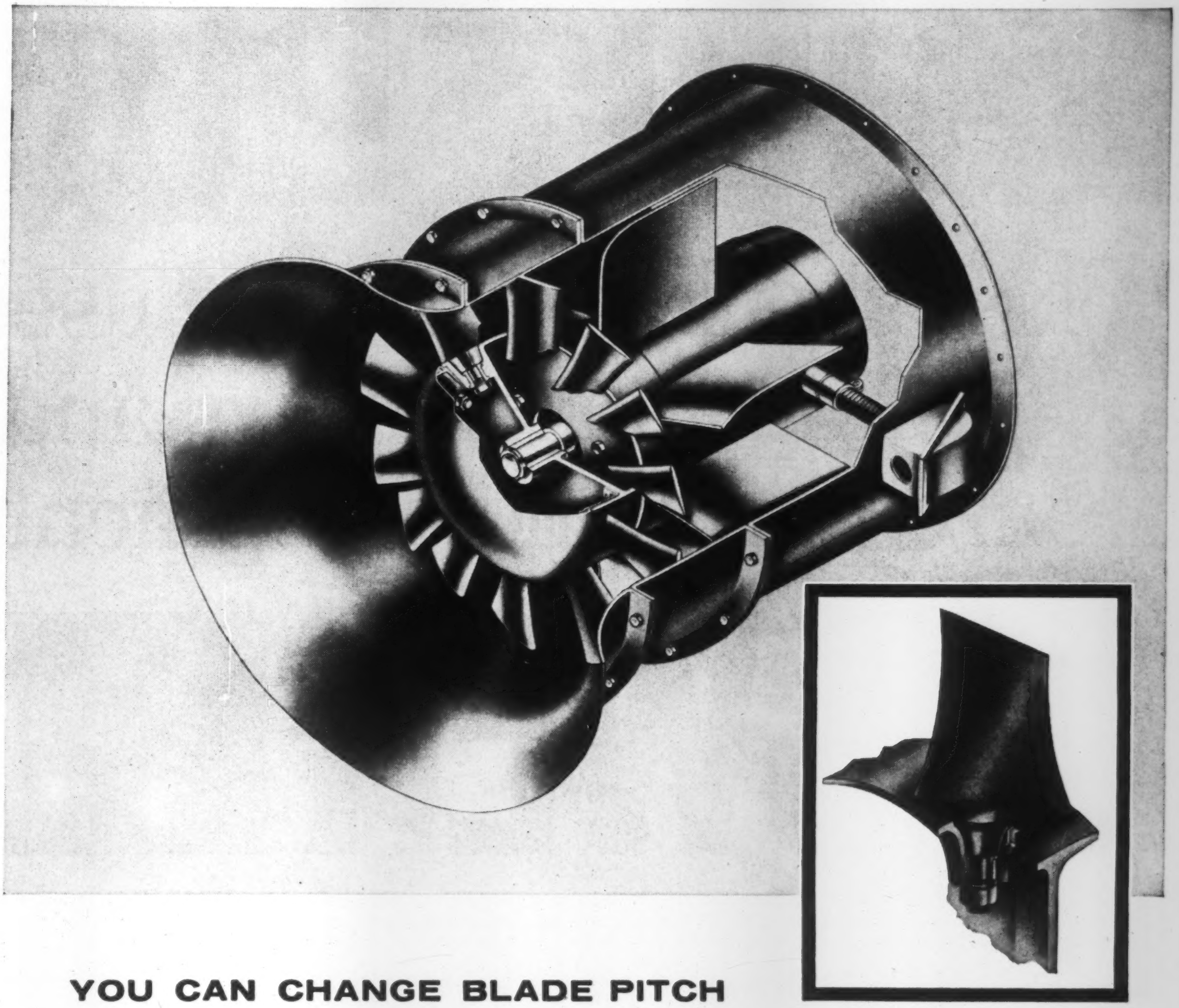
KEENEY PUBLISHING CO. AIR CONDITIONING HEADQUARTERS



YOU CAN CHANGE BLADE PITCH TO CHANGE VOLUME AND PRESSURE WITH

JOY AXIVANE FANS

If calculated and operational requirements differ . . . if system characteristics change . . . or if resistance is difficult to predict —Joy fans can solve your problem. The blade pitch is adjustable. The factory blade-setting can be changed quickly to provide either a wide pressure-range for any particular volume or a change in volume. The inset photograph shows how this can be done using only a common wrench.

Other advantages: The motor is inside the fan . . . no drive losses. This makes the fan unusually compact and efficient . . . easy to mount. There are *1600 standard models* in all combinations of horsepower, pressures, and volumes. Also available with V-belt drives. Send in the coupon now for complete information.

Joy Manufacturing Company, Oliver Building, Pittsburgh, Pa. In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

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Oliver Building, Pittsburgh 22, Pa.

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QUESTION

When should brazing be used for joining copper, brass and bronze parts and equipment?

ANSWER

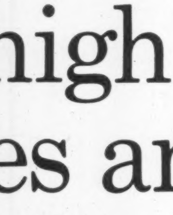
Always when corrosion, appearance, high strength, high pressures and high conductivity are factors.

J-21999

7 WESTINGHOUSE BRAZING ALLOYS

Industry's most complete line of Phos-Copper® and Phos-Silver* alloys for brazing copper, bronze and brass are detailed in a new bulletin. For your copy write: Welding Division, Westinghouse Electric Corporation, 4454 Genesee Street, Buffalo 5, New York.

* Trade-Mark



This Brazing Bulletin shows how and why

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS-TV MONDAYS

Now you can insist on these features in power roof exhausters

QUIET

NEVER NEEDS PAINTING

TOUGH and LIGHTWEIGHT

LOW COST

Nothing else offers so much as –

new SUPER/AIR-VAN® in FIBERGLAS*

CERTIFIED RATINGS

AUTHORIZED BY AMCA

Units with less than 12" wheels do not carry AMCA seal because AMCA codes do not apply to these small units.

For the first time: you can provide a power roof exhauster that is sound absorbent, almost maintenance free, corrosive resistant to salt spray, common acids, greases and other chemicals, light-weight and with far greater impact strength than steel or aluminum. These features are combined with a patented scroll design, attractive low silhouette and availability in any color. Capacities are 150-11,000 CFM. Static pressures to 4".

U. S. Pats. 2188741, 2526290

Pats. Pending

GALLAHER

The Gallaher Company

4108 Dodge Street Omaha, Nebraska

*TM Owens-Corning Fiberglas Corporation

Continuing research has proved new air purification system for hospitals

effective new technique

An effective new technique—positive air purification by Kathabar Systems—gives hospitals a potent weapon in their running battle against pathogenic organisms.

The quantitative removal of bacteria by Kathabar Systems has been established in over 4 years of tests by the Research Foundation of the University of Toledo, using instrumentation which is 99% effective in air sampling.

These tests show that Kathabar equipment removes 97% of all airborne micro-organisms in the contacted air stream. Applicability of this equipment has been proved in over 10 years of use by food and pharmaceutical plants and in comfort installations.

limits bacteria population

The continuous removal of 97% of the organisms entering a Kathabar unit has been confirmed by actual hospital readings. This means that a Kathabar System can guarantee that not more than 5 organisms per 10 cubic feet can enter an operating room. Test readings, as close as 6 inches to open wounds, have shown an average pick-up of less than 5 organisms per 10 cubic feet.

Added to its bactericidal efficiency, a Kathabar System will provide desired cooling for a hospital operating suite, when supplied with refrigeration energy. It will humidify or dehumidify as required.

new hospital specifications

These facts indicate that, with a Kathabar System, a hospital can specify the following conditions for its operating suites:

1. **Temperature:** to be controlled at 72-76° F.
2. **Humidity:** to be maintained at a minimum of 55% RH.
3. **Micro-organisms:** rooms to be maintained at a maximum of 10 organisms per 10 cubic feet (as measured by the 99% efficient all-glass impinger).

A Kathabar System is not dependent on filtering, nor is it an aerosol. It simply washes the air with a germicidal solution totally contained within the unit. Micro-organisms are entrapped in the solution by impingement on the contact surfaces.

odorless, stable, constant

The solution itself is odorless and non-volatile. Its effectiveness is constant, regardless of age or whether the unit is humidifying or dehumidifying.

Kathabar Systems are completely automatic and continuous. They are available for both operating room and complete hospital air purification.

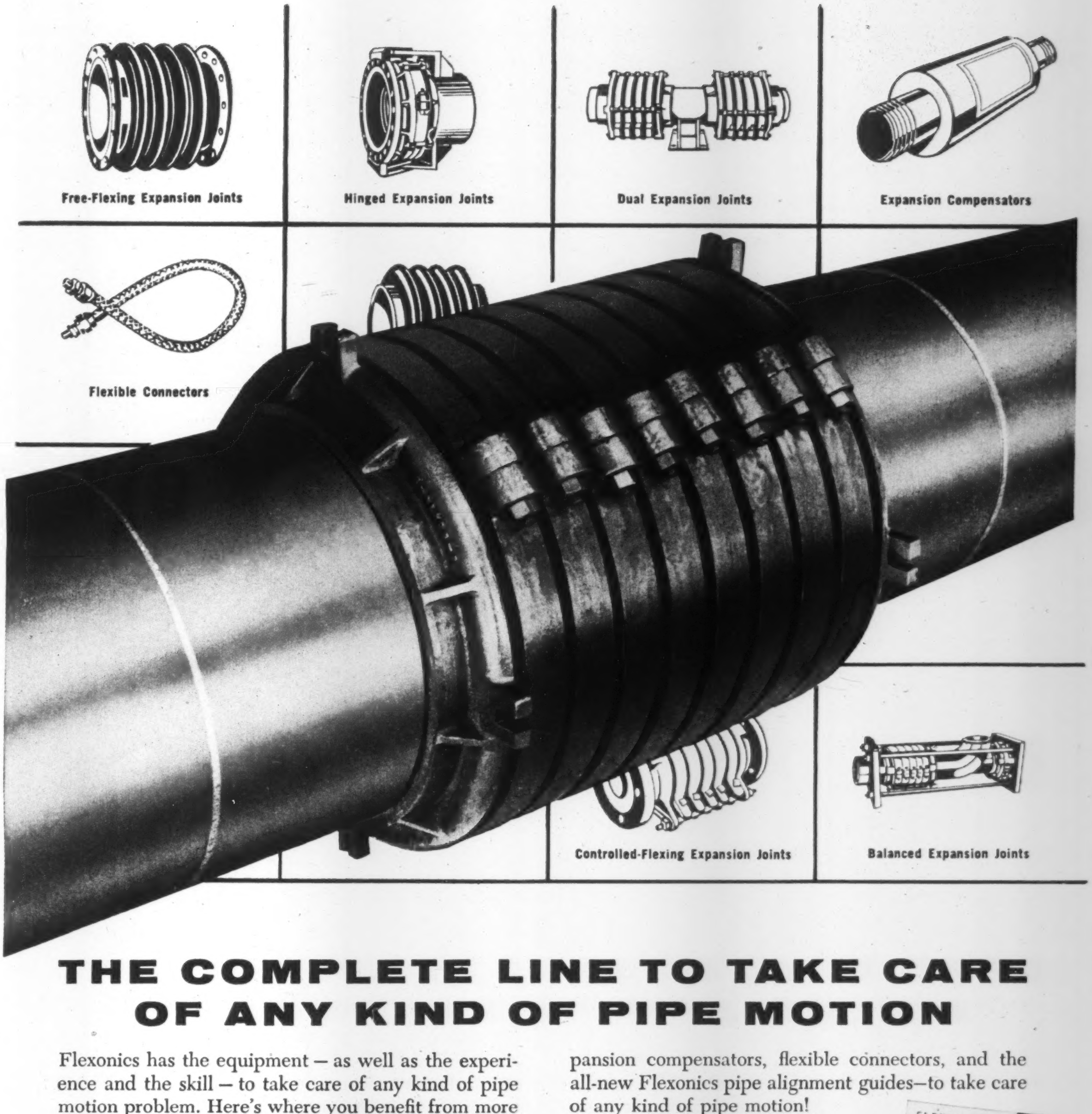
how can you obtain more data?

Write to Surface Combustion Corporation for full information.

Ask your hospital architect and consulting engineer to investigate.

AIR CONDITIONING & DRYING DIVISION
SURFACE COMBUSTION CORPORATION,
2384 Dorr Street, Toledo 1, Ohio

Kathabar® systems by Surface®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THE COMPLETE LINE TO TAKE CARE OF ANY KIND OF PIPE MOTION

Flexonics has the equipment – as well as the experience and the skill – to take care of any kind of pipe motion problem. Here's where you benefit from more research . . . more metallurgical care . . . more service . . . and now standard stock sizes for quick delivery from Flexonics warehouses. They all add up to expansion joints that you can *install and forget* – plus expansion compensators, flexible connectors, and the all-new Flexonics pipe alignment guides–to take care of any kind of pipe motion!

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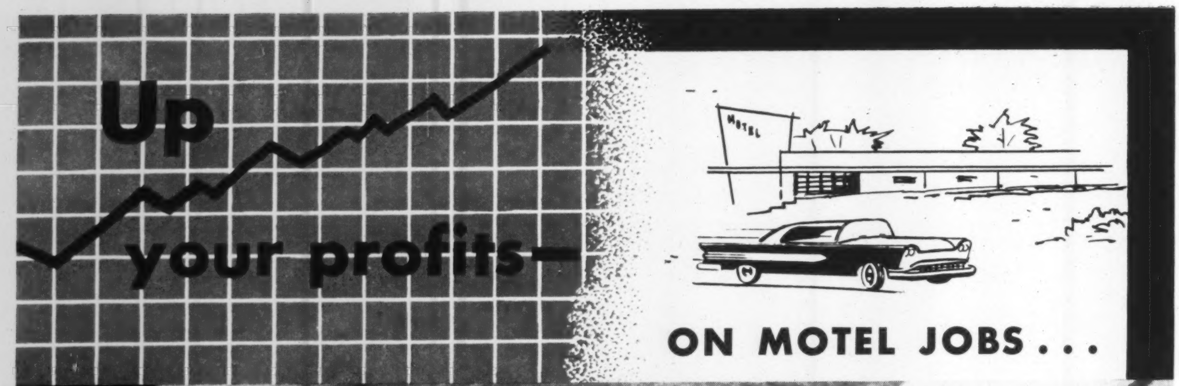

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SONOAIRDUCT®

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for slab perimeter heating or combination heating and cooling systems!

SONOCO Sonoairduct enables you to save installation time, labor and money — without lowering the quality of construction! Easy to handle — levels quickly. Made in 23 sizes — 2" to 36" I. D., with the larger diameters ideal as supply and return lines for motels, schools, shopping centers, churches, and industrial heating and cooling where duct is encased in concrete. Meets and exceeds F. H. A. criteria and test requirements for this type product.

Standard shipping lengths of 18'. Other lengths available. Can be sawed on the job. Aluminum foil lined. Free installation manual available. See our catalog in Sweet's.

For complete information and prices, write

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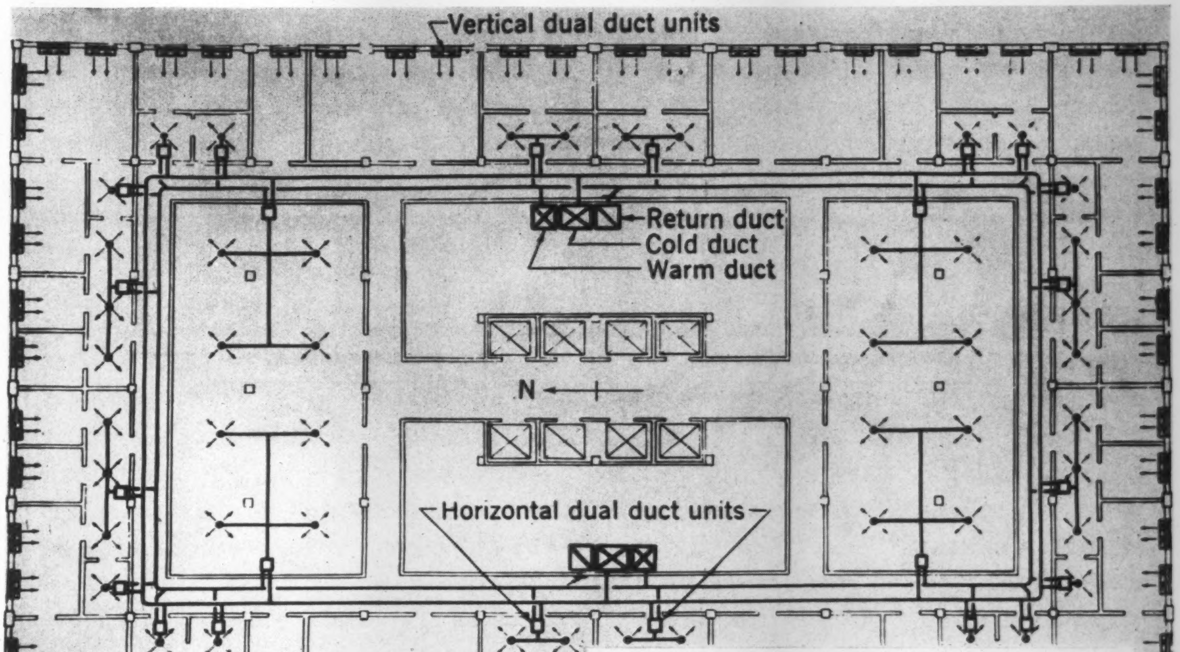
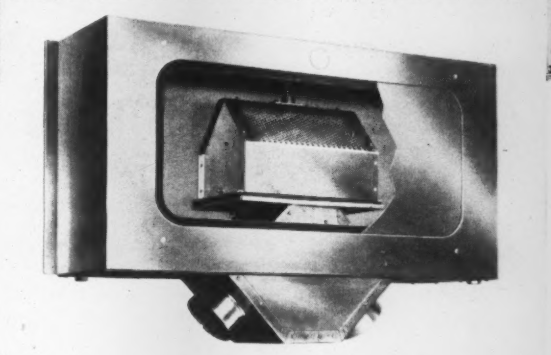
Construction Products

SONOCO PRODUCTS COMPANY

1603

HOW TO "BALANCE A BUILDING" BEFORE IT'S BUILT:





Shown above is a typical office building dual duct layout, 100 per cent air system. It is zoned to provide selective temperature control for each enclosure with Buensod vertical dual duct units at exterior walls. These under-window units may be connected to vertical risers, or to horizontal mains at the ceiling or on the floor below.

Illustrated: Buensod Type V window-wall unit with cut-away showing automatic volume control. This unit is designed for installation under windows to discharge vertically upward, quietly and without draft.

Balancing a building before it's built . . . almost an incongruity, yet Buensod does it consistently. Buensod air mixing units can be pre-set at the factory for desired volume and guaranteed within ±5% when installed. Whenever desired, a change in air volume may be made in the field by simple adjustment of one nut. This practically eliminates the tedious job of balancing after installation . . . a chore which can take months.

The secret is in Buensod's proven Automatic Volume Control. A simple tent-like apparatus maintains constant air quantity from each unit regardless of variance of static pressures on either inlet or outlet of mixing valve. This operates automatically . . . independent of any outside power source, sensing instrument or complicated linkage arrangement. The mixing valve is actuated by a local thermostat to provide the desired room temperature.

Buensod units are being designed into a constantly increasing number of new and renovated structures. Consider them for your next project.

BUENSOD DUAL-DUCT

Write for details to: **BUENSOD-STACEY** INCORPORATED **Buensod-Stacey, Inc., 45 West 18 Street, New York 11, New York**

AEROJET AMERICAN MACHINE & FOUNDRY ATLANTIC & PACIFIC TEA COMPANY ATOMIC
ENERGY COMMISSION BANK OF AMERICA BURROUGHS ADD MACHINE CADILLAC MOTORS
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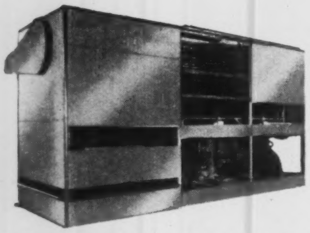
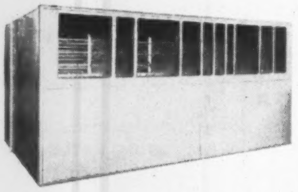


Model SCMZ

Self-contained Multi-Zone air conditioner — one of 18 basic Self Contained equipment models, available from 3 to 120 tons.

Model GMZ



Governair also "Satisfabricates" a complete line of Vertical, Horizontal and Multi-Zone Air Handling Units.

"SATISFABRICATED"©

. . . that's the copyrighted term that describes Governair air conditioning . . . equipment which is so basically flexible in design, that it can be manufactured to fit almost *any* space and load requirement.

This beneficial feature, pioneered and developed by Governair, is coupled with imaginative, tested engineering and quality workmanship. The end result is an installation that's a much *wiser* dollar investment.

Write for detailed information, or consult your yellow page directory for the name of our local representative.

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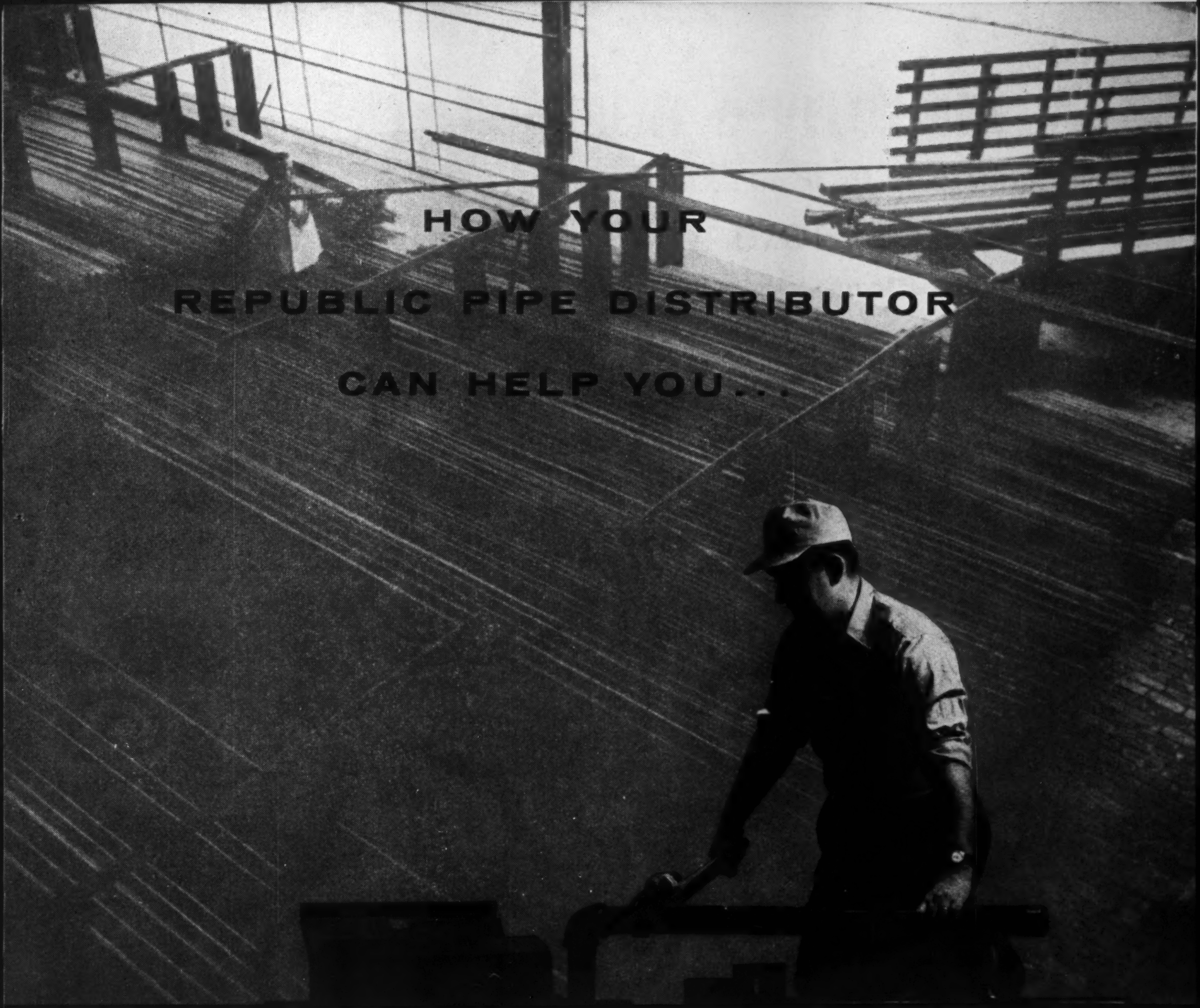

Meet future pipe needs with minimum inventory costs

No way has yet been found to foresee the future. This is why on-hand inventories of steel pipe, laid up against purely speculative estimates of future needs, can seriously cut profits from steel pipe system installations. If advance estimates prove inaccurate, such inventories can be a continuing source of high and unnecessary overhead costs. But you can reduce or eliminate these costs through the services offered by your Republic Pipe Distributor.

From his complete stocks, he can deliver steel pipe quickly as demand arises in the sizes and weights you need for any installation. He helps you avoid such overhead items as taxes, insurance, pipe-handling manpower, and equipment. Capital and storage space, once tied up in pipe inventories, are freed for more productive uses.

Furthermore, your Republic Pipe Distributor helps you augment operating efficiency in other ways. With far less time and trouble, the steel pipe needed for any job is delivered on schedule, where it is wanted. Valuable management time no longer need be devoted to estimating future pipe requirements. You are prepared to meet any situation.

Team up now with your local Republic Pipe Distributor to improve present and future handling of steel pipe inventories. Contact him at once for full information on the services he offers you.

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Most modern of its kind . . .

OWENS-ILLINOIS

New Atlanta Plant

Architects and Engineers:
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Associates, Atlanta, Ga.

General Contractor:
George A. Fuller Company,
Altanta, Ga.

Mechanical Contractor:
Standard Engineering
Company of Washington, D.C.

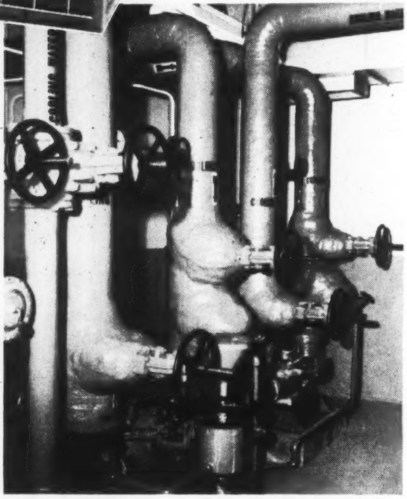
JENKINS VALVES control important service lines

DESIGNED to be the most modern glass container plant in the world, covering 619,000 square feet and highly automated, this new Owens-Illinois plant can produce millions of glass containers annually.

In the glass manufacturing operations trouble-free service piping lines are an essential. Cooling operations require a flow of recirculated water equal to 2-million gallons per day. The furnaces consume about 3-million cubic feet of natural gas per day.

The fact that Jenkins Valves, in large numbers, are used to control water, gas, steam, compressed air and air conditioning lines in this new plant will not surprise most experienced architects, engineers and contractors. For nearly a century, "JENKINS" has been a common specification to assure maximum reliability.

It will pay you to have this important assurance when you specify or install valves . . . especially since Jenkins Valves cost no more. Jenkins Bros., 100 Park Avenue, New York 17.



Some of the many Jenkins Bronze and Iron Valves which control the complex service piping system in the Owens-Illinois plant.

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LOOK FOR THE JENKINS DIAMOND

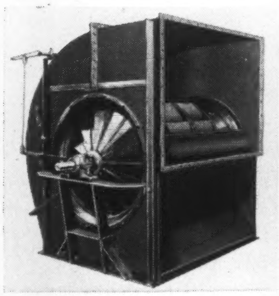
JENKINS®
SINCE 1864
Jenkins Bros

VALVES

Sold Through Leading Distributors Everywhere

EQUIPMENT DEVELOPMENTS . . .

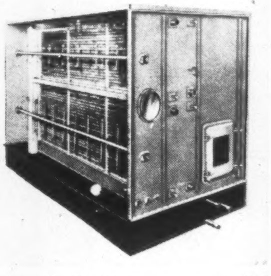
For reviews of Recent Trade Literature see page 250



Centrifugal Fan . . .

. . . incorporating advanced airfoil, backward curved blade design—*Clarage Fan Co., Dept. HPAC, Porter St., Kalamazoo 16, Mich.*

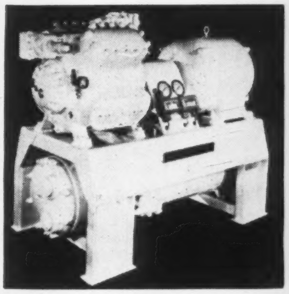
"Type AF Dynafoil" said to be particularly adaptable to mechanical draft and heavy-duty applications. Wheel is built with 12 aero-dynamically shaped blades which combine with streamlined contour of inlet to permit continuously smooth flow of air through the fan. Airfoil shaped blades are of one-piece die formed construction, welded to rim and backplate. Available in 13 sizes for mechanical draft and in Classes II, III, IV for heavy-duty industrial applications.



Sprayed Coil Dehumidifier

. . . in new low and high pressure, blow-through design—*American-Standard, Industrial Div., Dept. HPAC, Detroit 32.*

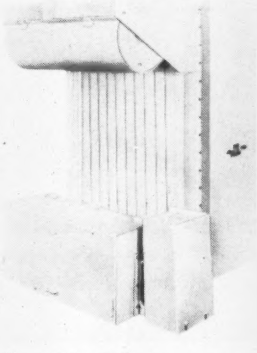
Blow-through models in both low and high pressure available in 127 sizes with capacities from 2310 to 45,900 cfm, and for operation up to static pressures of 9 in. water gage. Unit casing designed to provide airtight, watertight operation in single zone, multizone or dual duct blow-through systems.



Condensing Units . . .

. . . ranging in size from 7½ to 150 tons capacity—*Bell & Gossett Co., Dept. HPAC, 8200 N. Austin Ave., Morton Grove, Ill.*

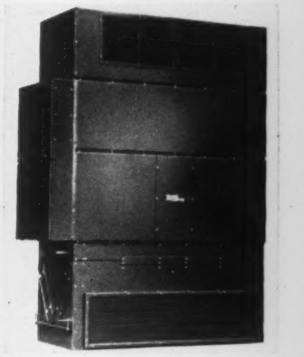
Condensing units composed of compressor, motor, condenser, base. Four compressor sizes—2, 4, 6, or 8 cylinders—available. Part sizes in components of large, small units interchangeable. Overall design of unit said to be low, compact.



Automatic Filter . . .

. . . based on basic "Rollotron" agglomerator-filter principle—*American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

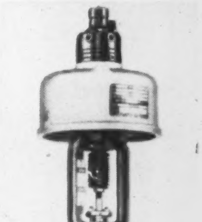
"Type B Rollotron" automatic filter said to combine high efficiency of electronic precipitator with low maintenance of renewable media fillter. Dry, electrostatically charged plates used to agglomerate atmospheric contaminates, hold them together by intermolecular attraction until they are picked up by air stream, deposited on renewable media of filter section.



Heating, Ventilating Units

. . . designed for "super-quiet" operation in school auditoriums, theatres, similar installations—*McQuay, Inc., Dept. HPAC, 1600 Broadway, N. E., Minneapolis 13.*

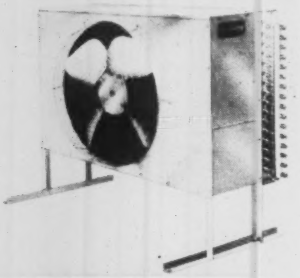
"Seasonvent" heating, ventilating units available in nine sizes for low static pressure applications from zero to ⅝ in. water gage, and seven sizes for high static pressure applications from ¾ to 1¼ in. WG. Capacities range 1250 to 15,000 cfm.



Split-Body Valves . . .

. . . designed for use in high temperature, high pressure control applications—*Kieley & Mueller, Inc., Dept. HPAC, 64 Genung St., Middletown, N. Y.*

Features cited include: large flow capacities; face-to-face dimensions based on ISA standards. Topworks, valve bodies, line flanges, plug and seat rings are of unitized construction, making 432 different valve combinations possible from single split body.



Air Cooled Condenser . . .

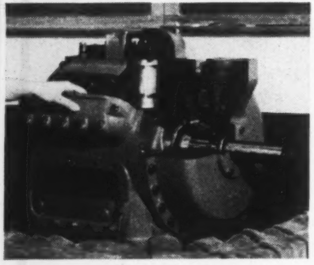
. . . designed to operate as normal air cooled condenser up to selected ambient temperature, then have condenser capacity supplemented with water above this temperature—*Dunham-Bush, Inc., Dept. HPAC, 179 South St., West Hartford 10, Conn.*

Design of unit said to combine advantages of air cooled condenser and utilize smaller size condensers. Design operating head pressures maintained under all ambient conditions and secondary system is capable of handling complete condensing load in event of condenser fan motor or belt failure.

All-Air Terminals . . .

. . . in three models developed to handle from 50 to 1700 cfm—*Carrier Corp., Dept. HPAC, Carrier Pkwy., Syracuse 1.*

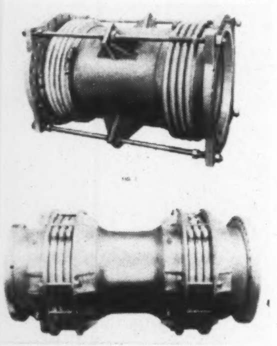
"Weathermaster" high velocity room terminal blending box has following features as cited by manufacturer: suitability for exterior and interior spaces; minimum distance (¾ in.) travelled by damper blades; effectiveness in eliminating sounds from high pressure air; volume regulating blade direct connected to control valve; hot, cold air streams mixed quietly. Each of three model lines designed for different systems: double duct; single duct with reheat; dual conduit.



Refrigeration Compressors

. . . in line of hermetic and direct coupled drive units—*Worthington Corp., Dept. HPAC, Harrison, N. J.*

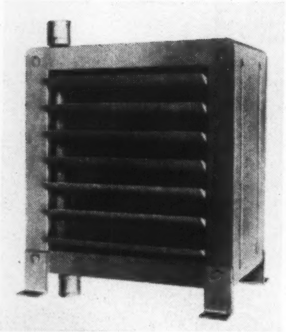
Features cited by manufacturer: engineered for quiet performance; close-running fit tolerances; rugged cast iron body and manifold; cushioned ring valves. Designed to operate at 1750 rpm direct coupled or hermetic arrangement. New line available in six sizes from 15 to 80 ton capacities. Bulletin "No. 1100-B103" describes product.



Expansion Joints . . .

. . . designed to accommodate pipe movement in any direction—*Zallea Brothers, Dept. HPAC, 815 Locust St., Wilmington 99, Del.*

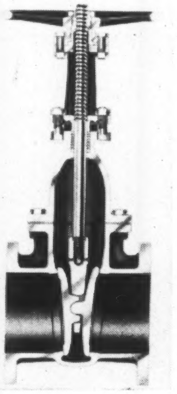
Packless, corrugated-bellows units protect power and process piping systems by absorbing displacement, including axial movement, lateral deflection, angular rotation, singly or in combination. Manufactured in standard sizes from 3 to 72 in. Available for pressures to 2500 psi and temperatures from −320 to 1600 F.



Unit Heater . . .

. . . designed for interior accessibility in installed position—*L. J. Wing Mfg. Co., Dept. HPAC, 140 Vreeland Mills Rd., Linden, N. J.*

Horizontal-flow heater recommended by manufacturer for small industrial and commercial applications. Heating element is of fin and tube extended surface type. Finned tubes are of seamless drawn copper. Flat oblong aluminum fins forced onto tubing for high heat transfer rates. Heater offered in five different sizes.



Gate Valve . . .

. . . from Types 316 and J-20 alloys suited to wide range of corrosive conditions—*Jenkins Bros., Dept. HPAC, Room 34, 100 Park Ave., New York 17.*

Gate valves fitted with split wedge of ball and socket design to automatically adjust to tapered seating surfaces. Packing is of chevron-type teflon, with body of through-port design and end flanges conforming to MSS SP-42 specifications. Size range of 150 lb flanged end valve (Fig. 1327): ½ to 8 in.; of 200 lb screwed end valve, (Fig. 1326): ½ to 2 in.

How **B&W JOB-MATCHED TUBES** meet Heat-Exchanger requirements

With B&W Job-Matched Heat-Exchanger Tubes you get:

- . . . tube tolerances and mechanical properties, controlled for ease of fabrication
- . . . a wide range of steels to meet any set of operating conditions
- . . . a complete range of tube sizes, for any type of heat exchanger

This means ease of fabrication to the heat-exchanger manufacturer — long service life to the heat-exchanger user—and ease of tube replacement to those concerned with maintenance.

For complete information about B&W Job-Matched Heat-Exchanger Tubes call the local B&W District Sales Office or write for Bulletin TB-329. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

B&W

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TUBULAR PRODUCTS DIVISION

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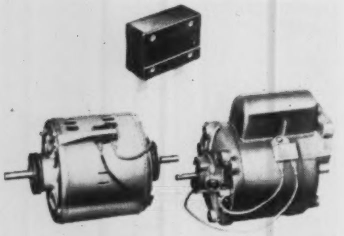
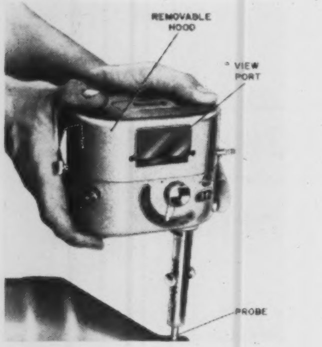
Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals



Motor Overload Protector

...developed to trip in response to either rising temperature of motor or excessive current draw—*Mechanical Products, Inc., Dept. HPAC, Jackson, Mich.*

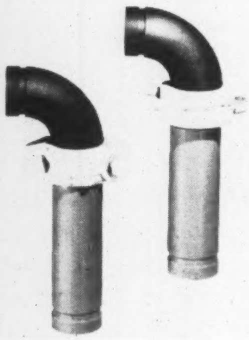
"MP-1620" breaker is adaptable to use of fans, disposal systems, air conditioners, pumps, other equipment or installations with fractional hp motors. Current is automatically shut off when motor temperature or current rises to dangerous level, then restores motor operation when temperature or current is dropped. Can be attached to surface of motor housing.



Vibration Instrument . . .

...designed to magnify, permanently record frequency, amplitude, wave form of vibrations, other mechanical motions—*Korfund Co., Inc., Dept. HPAC, 48-01-F 32nd Pl., Long Island City 1, N. Y.*

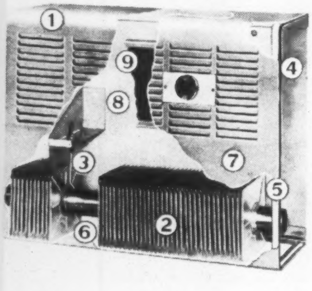
"Hand Vibrograph" available with both ink and waxed paper recording (uses 1 in. wide tape), tape takeup reel for storing readings. Has variable tape speed intended to simplify reading of high frequency recording. Can be used to measure rpm of rotating equipment by placing probe against machine housing. Frequency range is zero to 20,000 cpm; magnifications, 2, 4, 5, 10, 20 times; running time, 1½ to 4½ minutes; weight, 4¾ lb.



Plastic Fittings . . .

...developed for quick-jointing plastic pipe with company's mechanical couplings—*Victaulic Co. of America, Dept. HPAC, P. O. Box 509, Elizabeth, N. J.*

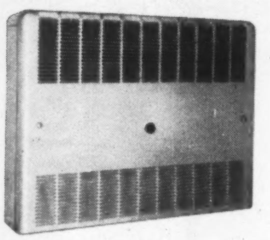
Line of plastic pipe fittings with grooved ends molded in sizes from 1½ to 8 in. Available in regular polyethylene, special high temperature linear type polyethylene, polypropylene. Elbows, tees, crosses, 45 deg laterals, reducers, caps, flanged adapter nipples for jointing to bolted flange systems produced in all three materials.



Convector-Radiation . . .

...for heating areas where large window or glass-wall surfaces create heating problems—*Radiant-Ray Radiation, Inc., Dept. HPAC, 464 Hartford Ave., Newington, Conn.*

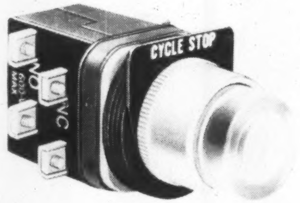
"Sil-vector" airfoil radiation is constructed of die formed heavy gage cold-rolled steel with aluminum fins bonded to copper tubing in lengths to 8 ft.



Cooling, Heating Units . . .

...designed to meet smaller space and capacity requirements of small commercial installations—*Dunham-Bush, Inc., Dept. HPAC, 179 South St., West Hartford 10, Conn.*

"CHC" series available in two sizes: Models "CHC-150" and "CHC-300". Designed for free standing use, but adaptable for semi-recessed applications; can be wall-mounted, fully exposed or semi-recessed, as required.



Push Button Control . . .

...combining push button with pilot light in single unit—*Allen-Bradley Co., Dept. HPAC, 136 W. Greenfield Ave., Milwaukee 4.*

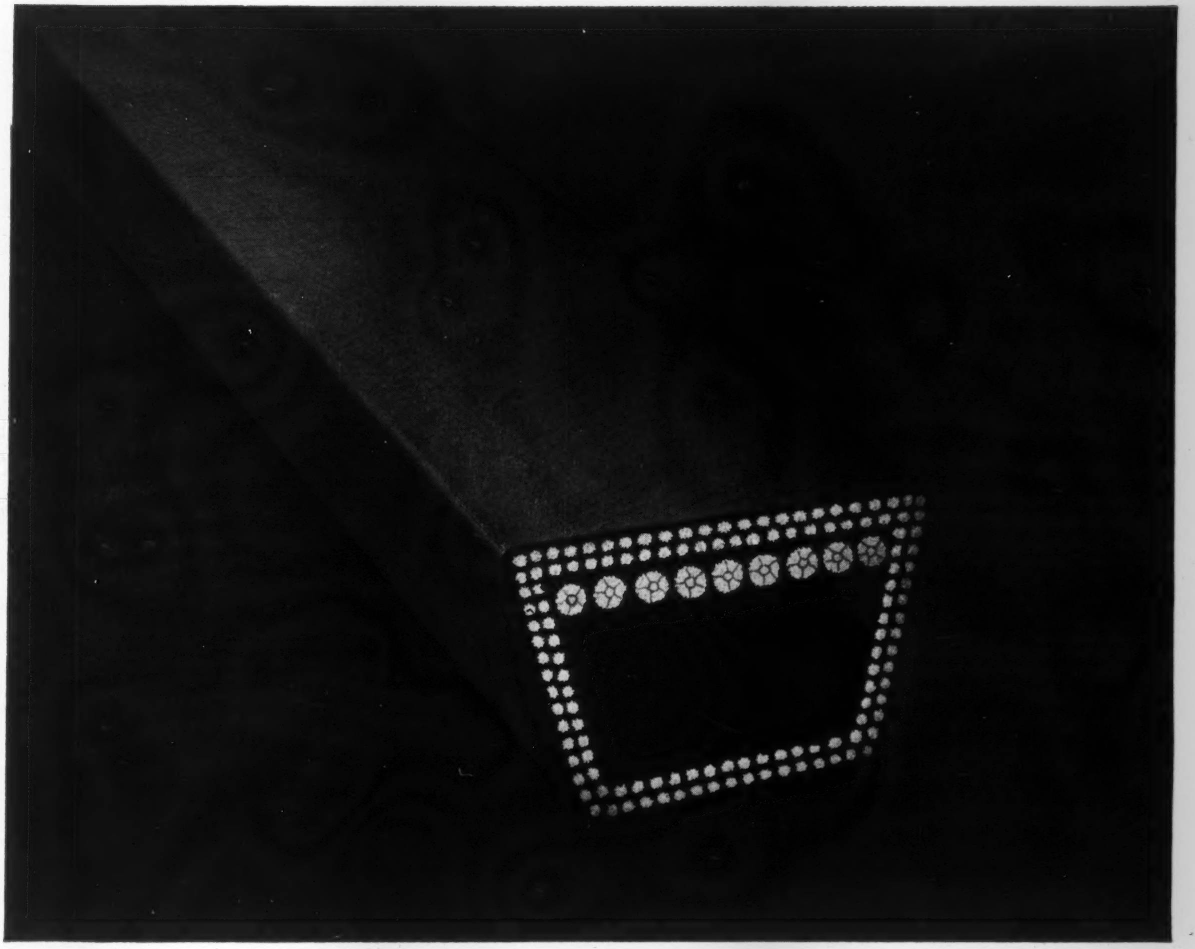
Illuminated, heavy duty push button unit completely sealed to exclude oil and coolants. Contact blocks have double break "NONC" contacts of silver alloy. Step-down transformer built into unit to supply 6 volt pilot lamps.

Duct Sealing Tape . . .

...designed as means of joining and sealing sections of ductwork in heating, ventilating, air conditioning systems—*Permacel, Dept. HPAC, New Brunswick, N. J.*

Vinyl coated, pressure sensitive duct sealing tape is combination of cloth backing and specially compounded adhesive. "Permacel 676" said to have excellent resistance to extreme temperature fluctuations, as well as solvents, abrasions, and aging.

V-BELTS



Quiet . . . smooth . . . vibration at the vanishing point

Unerring electronic controls; new methods of curing; the facilities of the largest and most modern plant devoted exclusively to the manufacture of endless transmission belts—these are the factors that bring to the heating and air-conditioning industry the one V-belt that erases vibration to the vanishing point.

The U. S. V-belt contributes greatly to the silent and efficient operation of fans, pumps, compressors, blowers—large or small—wherever power transmission is required for air-conditioning and refrigeration units.

• • •

When you think of rubber, think of your "U.S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

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WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

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The Beaver Who Was Very Uneager

Once upon a time . . .

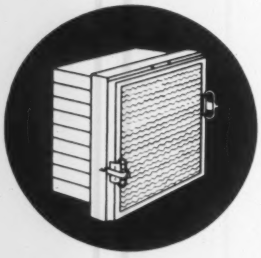
there was a beaver who seldom seemed to work. While the other beavers were busy with the gnawing problem of selecting air filters, their uneager buddy would slip away.

One day they discovered that he had been meeting his friendly Far-Air man down by the dam and had been busy checking on a sample Far-Air HP filter. When they saw how easy this preformed filter would be to install . . . his secret was out! The beaver they thought was uneager had led them to a better filter . . . by a damsite.

Now all the beavers specify the economical Far-Air HP.

Moral:

Compare before you specify. Far-Air HP filters may meet your air filter requirements better. Gnaw off the coupon below, drop it in the mail . . . and relax.



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FARR COMPANY
P. O. BOX 45187 AIRPORT STATION
LOS ANGELES 45, CALIFORNIA

Timber-r-r! Send me the new HP Filter bulletin before the pond freezes over.

NAME__________

TITLE__________

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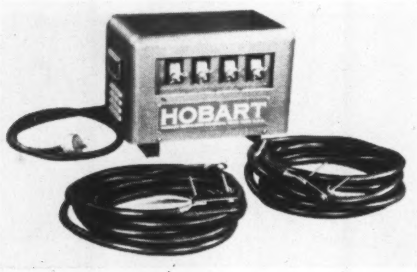
EQUIPMENT DEVELOPMENTS

Continued



Pipe Thawer . . .

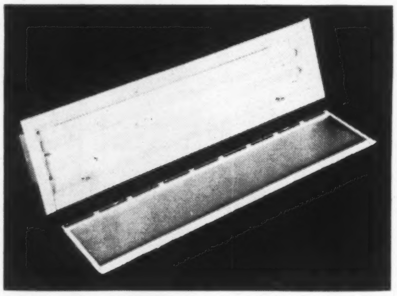
. . . in portable design operating from domestic a-c electric circuits of 110/220 volts, single phase, 50 or 60 cycles—*Hobart Brothers Co., Hobart Sq., Dept. HPAC, Troy, Ohio.*

"Porta-Thaw" unit complete with 10 ft power cable with plug and receptacle and two 20 ft thawing cables with lugs and pipe clamps. Case measures 16⅜ × 11½ × 10¾ in. and unit weighs 63 lb. Transformer rated at 300 amp, 10 volts on 100 precent duty cycle.

Pressure Control . . .

. . . in explosionproof design for air, gas, liquid piping systems—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown 72, Mass.*

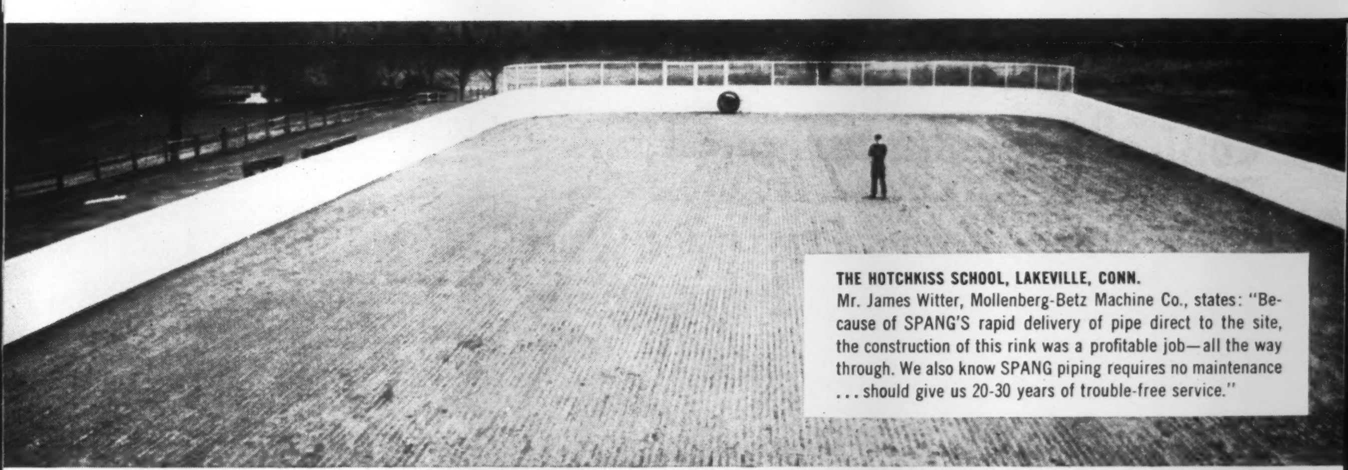
Calibrated pressure setting on "Type H95" pressure control made by rotating single turn adjustment knob and pointer against fixed, calibrated dial. Line has 22 models available in variety of adjustable ranges between zero and 500 psi. Bellows comes in following materials: phosphor bronze, brass, monel, stainless steel. All switches are single pole, suitable for ambient temperatures to 180 F. Rated for 15 amp at 115 or 230 volts a-c.



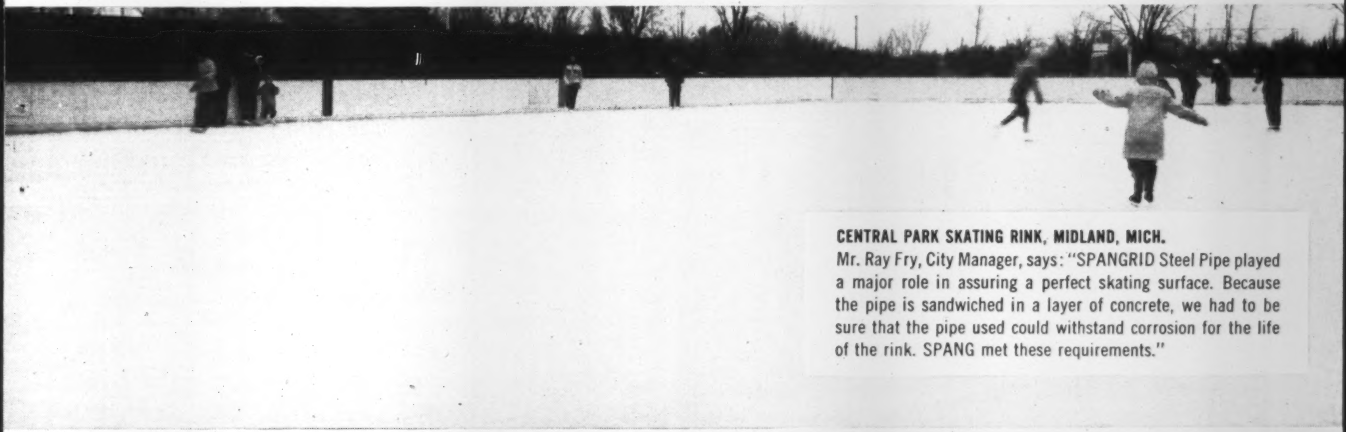
Air Diffuser . . .

. . . combined with ceiling light fixture—*Pyle-National Co., Dept. HPAC, 1334 Kostner Ave., Chicago 51.*

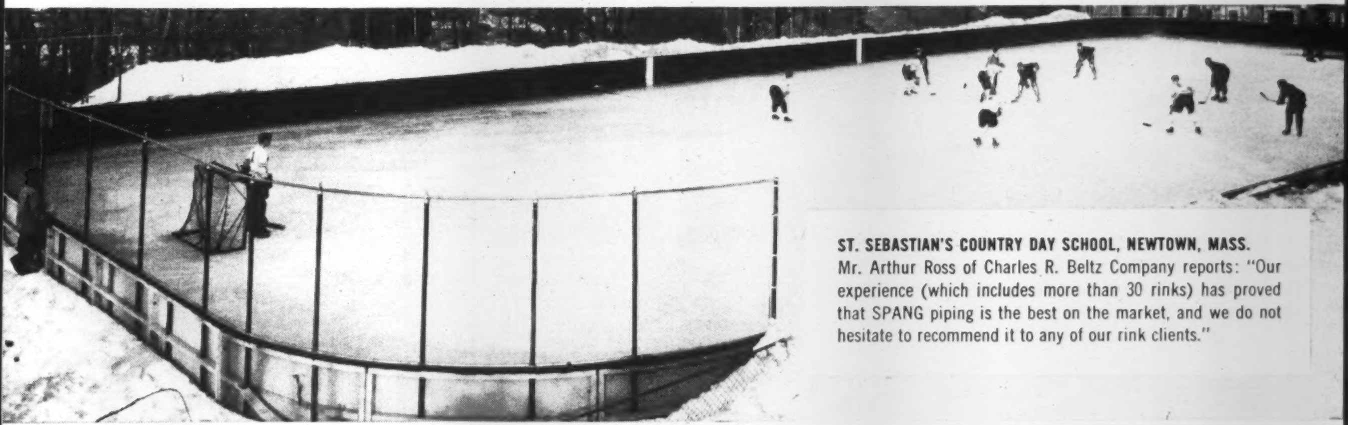
"Multi-Vent Troffer" consists of drop ceiling, flush fluorescent lighting fixture combined with vertically directed air diffuser. Features cited: draft free air distribution; complete concealment of air diffuser; elimination of dirt deposits on adjacent ceiling material; flexibility of partition movement without adjustment or relocation of air diffusers.



THE HOTCHKISS SCHOOL, LAKEVILLE, CONN.
Mr. James Witter, Mollenberg-Betz Machine Co., states: "Because of SPANG'S rapid delivery of pipe direct to the site, the construction of this rink was a profitable job—all the way through. We also know SPANG piping requires no maintenance . . . should give us 20-30 years of trouble-free service."



CENTRAL PARK SKATING RINK, MIDLAND, MICH.
Mr. Ray Fry, City Manager, says: "SPANGRID Steel Pipe played a major role in assuring a perfect skating surface. Because the pipe is sandwiched in a layer of concrete, we had to be sure that the pipe used could withstand corrosion for the life of the rink. SPANG met these requirements."



ST. SEBASTIAN'S COUNTRY DAY SCHOOL, NEWTOWN, MASS.
Mr. Arthur Ross of Charles R. Beltz Company reports: "Our experience (which includes more than 30 rinks) has proved that SPANG piping is the best on the market, and we do not hesitate to recommend it to any of our rink clients."

You can get these advantages, too—with SPANGRID Steel Pipe. Follow the example of those who have found SPANGRID Steel Pipe ideal for skating rink installations . . . and for radiant heating and snow melting systems, too. *Quality controlled* during forming and welding, SPANGRID helps speed installations, assures *top-quality* performance. Next job, make it steel pipe . . . make it SPANGRID.

Send for your free booklet, STEEL PIPING IN ICE RINKS

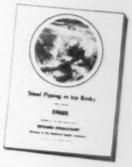
This booklet has helpful information on the construction of over ninety skating rinks throughout the United States and Canada. To get your copy, mail the coupon.

SPANG CW STEEL PIPE

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH 30, PA.



THE NATIONAL SUPPLY COMPANY
Two Gateway Center
Pittsburgh 30, Pennsylvania

Please send me your free booklet,
STEEL PIPING IN ICE RINKS

Name ____________________

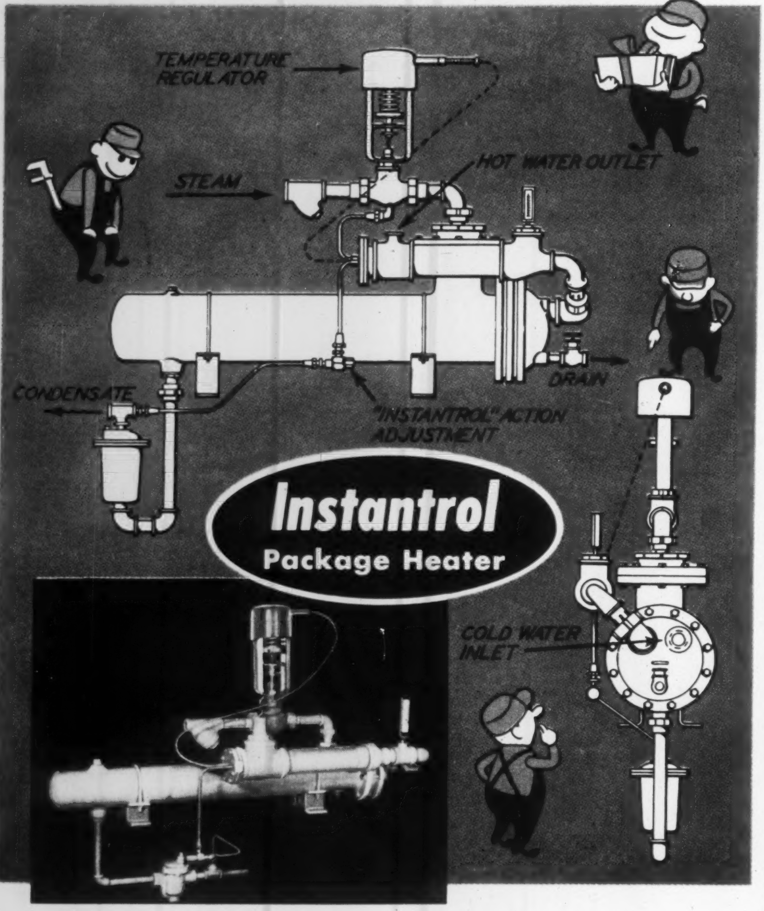
Title ____________________

Firm ____________________

Address ____________________

City ____________________ Zone ______ State ______

Controlled Instantaneous Heater
Now Available as Packaged Unit



Control heated liquids accurately — regardless of load — with this new "package." All the small space, low-cost advantages of instantaneous heaters PLUS the accuracy needed for hot water supply in wash rooms, shower rooms and for industrial liquid heating! Patented "Instantrol" bulb provides "heat anticipating" effect for complete control under varying loads — and a single-seated, tight-closing regulator valve prevents temperature build-up on long standby periods!

Complete "package" includes heater, regulator and Instantrol bulb, steam strainer, mechanical steam trap, discharge thermometer and necessary fittings . . . assembled and pre-tested, ready for operation after on-job connections.

Write for Bulletin EH-111

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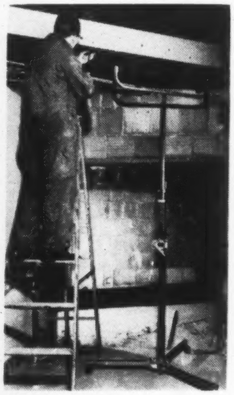

Duct, Pipe Hoist . . .

. . . incorporates universal cradle with three sets of adapters—*Lantz Mfg. Co., Inc., Dept. HPAC, Valparaiso, Ind.*

"Hi-Hoist" designed to lift heating, piping, and air conditioning materials weighing up to 100 lb to a height of 13 ft. Telescoping lift mechanism controlled by non-slip, cable drum crank operation. Unit's three legs roll on 3 in. casters.

Tubing Tool . . .

. . . designed to operate with no heating, pre-treatment of pipe—*Streeter Sales Co., Dept. HPAC, 710 Commerce Bldg., Erie, Pa.*

"T Turner" tubing tool said to cold draw "T" on any type of copper pipe 1¼ through 4 in. at shop-bench or job location in 4½ min. Complete set includes clamps, hole saws, spinners, wrench.

Skidmore Pumps

2 New Bulletins

MORE CAPACITY
MORE PERFORMANCE

NEW!
improved
TYPE CCVS
close-coupled design

Send for Bulletin No. 21-C

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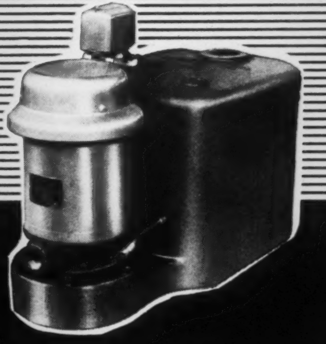
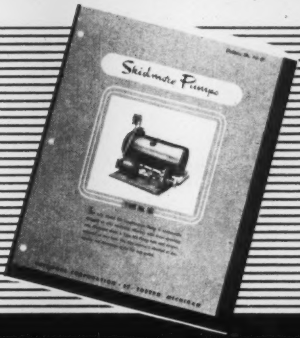


TYPE CCVS


Skidmore Pumps

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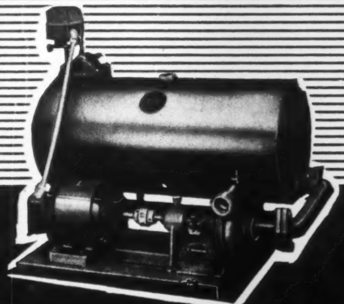

TYPE HS

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Since 1921

SKIDMORE PUMPS

SKIDMORE CORPORATION
ST. JOSEPH, MICHIGAN

ACCEPTED

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ROOF VENTILATION

Whatever your ventilating needs, be sure to see how Allen equipment can meet your requirements efficiently and economically.

NEW "I-LINE" for EYE APPEAL

The new "I-Line" provides an attractive low contour, assuring maximum capacity or efficiency with the minimum over-all height.

POWERFUL "VD" for HIGH VELOCITY

By moving a large volume of air at high velocity, this Vertical Discharge fan keeps fumes from sifting back into building.

Allen

... is prepared to investigate ventilating problems and plan systems for the efficient removal of heat, fumes, vapor or dust.

WIND-DRIVEN TURBINES

Three types of Allen turbines take full advantage of the economy of natural air movement.

EXHAUST FANS

Remote drive Staxauster is designed to handle corrosive fumes, and/or high temperature air.

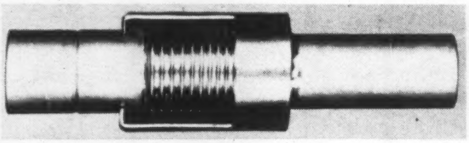
THE ALLEN LINE

Write today for catalog that gives specifications and performance data on these and other units in the Allen ventilator line.

ALLEN ENGINEERED VENTILATION

ALLEN COOLER & VENTILATOR, INC.
ROCHESTER, MICH.

Roof Ventilators for Every Commercial and Industrial Need
REPRESENTATIVES IN PRINCIPAL CITIES



Expansion Compensator . . .

. . . developed for hot water and steam heating installations—*Techniflex Div., Dept. HPAC, 55 Jersey Ave., Port Jervis, N. Y.*

"Line-Flex" expansion compensator has permanent silver soldered joints with no gaskets, O-rings. Installed by soldering male, female end fittings into line. Available in copper in sizes from ½ to 2 in.

Arc Welder . . .

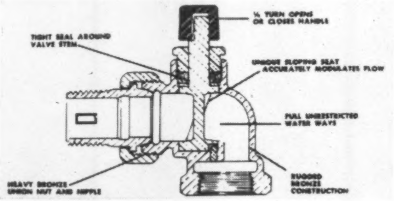
. . . in combination with 5 KVA a-c power supply—*Lincoln Electric Co., Dept. HPAC,* 22801 *St. Clair Ave., Cleveland* 17.

"Weldanpower" has heavy duty, air cooled, 4 cycle 13.1 hp, 2000 rpm "Model FTD" engine providing 115 or 230 volt, 60 cycle, a-c single phase power coupled with 200 amp a-c arc welder. Unit will start and run motors up to 3 hp. Speed when used as power supply unit is 1820 rpm. Maximum continuous current for welder at 230 volts is 18.2 amp.

Multiple Temperature Switch . . .

. . . for use in air conditioning or heating—*Automatic Devices Co., Inc., Dept. HPAC,* 714 *Hillgrove Ave., Western Springs, Ill.*

Temperature resetting device actuates two to six switches, performing multiple switching functions: load or unload compressors; energize additional boilers or other heat transfer devices as load changes; energize air conditioner at selected outdoor temperaure. Operating temperature for each switch is independently and infinitely adjustable throughout operating range. Available in several capillary lengths with short rigid immersion type bulb or with extended temperature sensitive bulb made of flexible tubing.


½ TURN OPENS OR CLOSES HANDLE
TIGHT SEAL AROUND VALVE STEM
UNIQUE SLOPING SEAT ACCURATELY MODULATES FLOW
FULL UNRESTRICTED WATER WAYS
HEAVY BRONZE UNION NUT AND NIPPLE
RUGGED BRONZE CONSTRUCTION

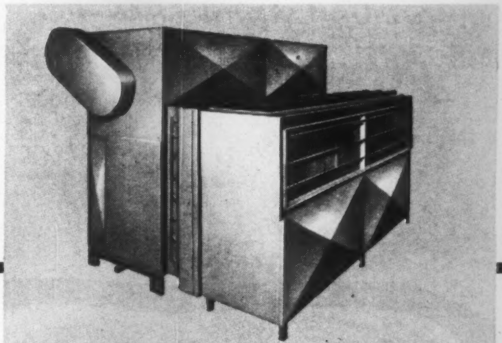
Circulator Valve . . .

. . . for making water flow proportional to valve—*Dunham-Bush, Inc., Dept. HPAC,* 179 *South St., West Hartford* 10, *Conn.*

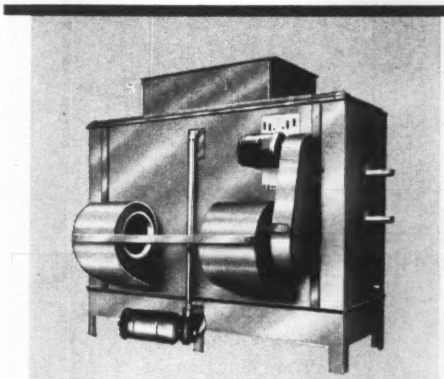
Circulator valves applicable to all types of forced water heating or cooling systems, according to manufacturer.

WORTHINGTON *relies upon*

WOLVERINE TUBE



Worthington Central Station Air Conditioning Unit



Worthington Model EVF Evaporative Condenser

"CLIMATE CONDITIONED AIR BY WORTHINGTON"– WITH TUBING BY WOLVERINE

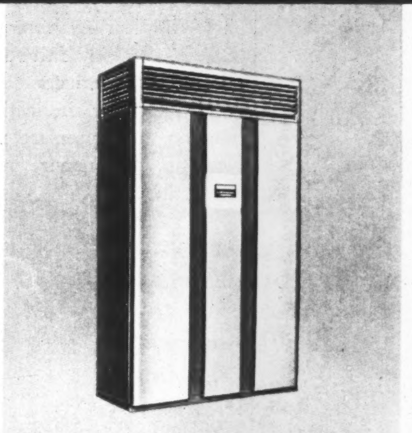
One of the proudest names in the heating, refrigeration and air conditioning industry is that of the Worthington Corporation of Harrison, New Jersey.

For many years Wolverine Tube has been a trusted Worthington supplier—is proud of the part its tubular products have played in Worthington's success. Of this relationship Worthington says: "For a good many years Worthington Corporation has relied on Wolverine tubing for many of its product applications. This is consistent with our efforts to provide the most reliable and efficient equipment possible."

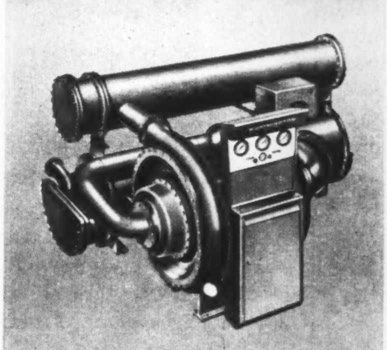
Wolverine supplies Worthington with different types of copper alloy tubing. There is, for example, prime surface tubing in both straight length form and in fabricated hairpin bends for use in heater coils and evaporators, etc.

Helping Worthington maintain maximum heat transfer capacity in the smallest possible space is Wolverine Trufin® Type S/T—the original, integrally-finned tubing for shell and tube condensers.

Supplying Worthington's tubing needs is another example of Wolverine Tubemanship at work for the benefit of American industry. Wolverine Tube would consider it a privileged trust to supply your tubular needs. For complete information about Wolverine products and services write for your copy of "Wolverine Serves The Refrigeration Industry."



Worthington Packaged Air Conditioner



Worthington Hermetic Centrifugal Refrigeration System

CALUMET & HECLA, INC.
CALUMET DIVISION
URANIUM DIVISION
GOODMAN LUMBER DIVISION
WOLVERINE TUBE DIVISION
In Canada:
CALUMET & HECLA OF CANADA LIMITED
WOLVERINE TUBE DIVISION
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CALUMET & HECLA, INC.
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Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

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SALES OFFICES IN PRINCIPAL CITIES

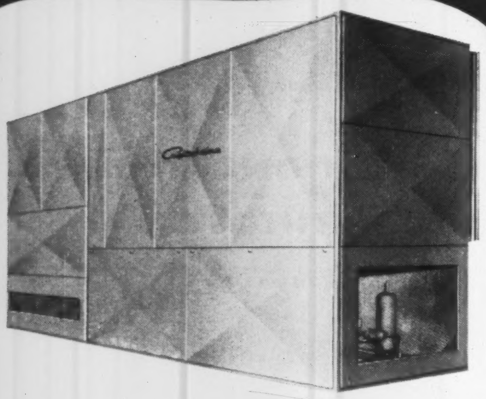
EXPORT DEPT. 13 E. 40TH ST., NEW YORK 16, N.Y.

For Unmatched Flexibility

National-U.S.

Central Station

Packaged Air Conditioning



7½-60 h.p.

water-cooled
or
evaporative condenser

Water-cooled or evaporative condenser models in nine sizes from 7½ to 60 h.p. provide a selection from which a combination can be arranged to fit any particular situation. Each model is available in different arrangements, matched to meet any space requirements.

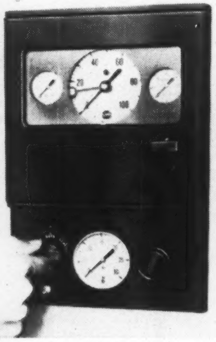
All units are completely engineered and packaged—require only power, ductwork and water supply connections for quick installation. And, all are factory pre-tested to minimize performance testing time.

Write today for Form AC-1001 describing the new Capitolaire Central Station *Packaged* Air Conditioning System, or contact your nearest National-U.S. representative. He'll be glad to help you.

National-U.S. Radiator
CORPORATION
HEATING AND AIR CONDITIONING DIVISION
Johnstown, Pennsylvania
In Canada: 77 York Street, Toronto
58-21
Sixty years in thermal hydronics

EQUIPMENT DEVELOPMENTS

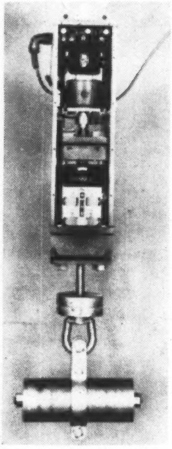
Continued



Control By-Pass . . .

. . . developed for use with company's line of pneumatic controllers—*U. S. Gauge, Div. of American Machine and Metals, Inc., Dept. HPAC, Sellersville, Pa.*

Prime function of control bypass is cutting off control air to valve (or damper, etc.) and for positioning valve manually. Unit mounts directly below indicating controller. Measures 8½ × 11½ in. Unit consists of four-position air transfer switch, 2½ in. dial gage for indicating manually regulated air pressure and a manual loading air pressure regulator with adjusting knob.



Pipe Hanger . . .

. . . designed to give constant support with unlimited load ranges and travel—*Grinnell Co., Inc., Dept. HPAC, 260 W. Exchange St., Providence 1, R. I.*

"Stress-Trol" provided as means of forcing end stresses back into piping

octagon VC

ROOF VENTILATORS

MAXIMUM
AIR VOLUME
PER DOLLAR
INSTALLED COST

AEROMATIC
AIRPHLO
AIR-X-IT
LOUVENT
SIPHON
JUNIOR
RIDGEVENT
HEAT-X-IT

Low construction and installation costs, through the interlocking principle of design, make OCTAGON roof ventilators the logical choice for industrial, commercial and institutional buildings. The wide variety of ventilators includes exhausters and intakes, power or gravity types, high or low velocity, vertical or horizontal air motion.

All are of high capacity and all rigidly meet specifications. All are fully guaranteed against latent defects and all capacity ratings are certified. Complete engineering services are available as are OCTAGON custom built ventilators for special installations.

OCTAGON VENTILATOR CO.

5826-32 SO. OAKLEY AVE. • CHICAGO 36, ILLINOIS
Represented in Principal Cities

Things to Think About in Selecting Sidewall Diffusers

…aspiration, aspect ratio, noise levels, smudging, and other factors

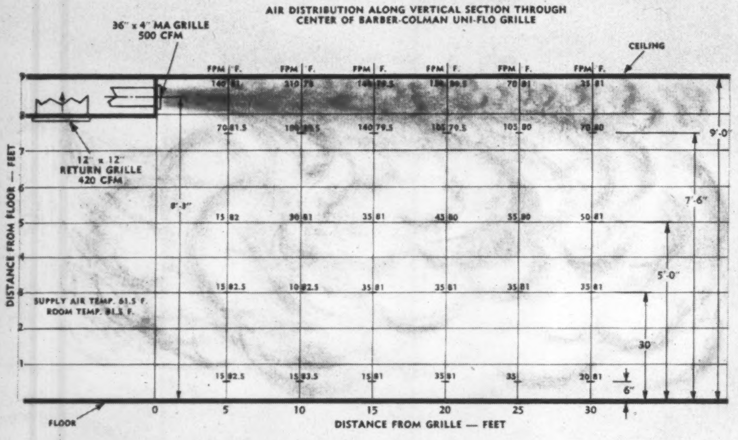


Fig. 1 Uni-Flo Grille Traverse — This charts the results you can predict and deliver with Uni-Flo grilles. Only Uni-Flo grilles are true sidewall diffusers guaranteed to perform in accordance with the published data.

A sidewall diffuser has three basic functions to perform:

1. Attractively cover the duct opening in the wall.
2. Impart direction to air flow.
3. Diffuse the conditioned air thoroughly and rapidly before it reaches the occupancy zone.

If a "diffuser" doesn't truly diffuse, it can drop a solid mass of cold air onto occupants of the room. One way to get around this problem is to direct the air flow from the diffuser toward an unoccupied area of the room. Another method is to use ceiling diffusers even when sidewall diffusers would be easier and more economical to install. Neither solution is ideal.

The Answer

Barber-Colman Uni-Flo sidewall diffusers provide an efficient answer to the problem. They provide very thorough aspiration. A turbulence is created which keeps the cooled air above the occupancy zone for the full length of throw. Conditioned air literally "trickles" into the room. Rapid warmup is secured. There is no mass of cold air to disturb human comfort.

The requirements outlined in this quote are from Heating, Ventilating, Air Conditioning Guide, '58, chap. 30:

"The air discharged from a wall outlet should not reach the occupied zone until the velocity has fallen to about 50 fpm. Therefore, the outlets should be located high enough for the air stream at the termination of throw to be not less than five or six feet above floor level. Or, in other words, the drop should not be more than the difference between mounting height and zone of occupancy."

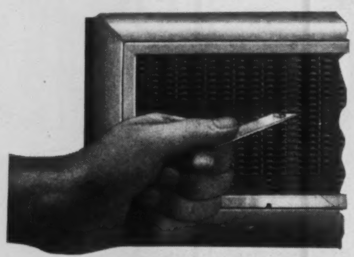


Fig. 2 Barber-Colman Uni-Flo Sidewall Diffuser — Note grille design which creates controlled air turbulence for complete aspiration.

It is almost impossible to meet this requirement in a low-ceilinged (9 ft) room without the aspiration provided by Barber-Colman Uni-Flo sidewall diffusers.

Fig. 2 shows how the grille of the Barber-Colman Uni-Flo sidewall diffuser is designed to create air turbulence. This is in direct contradiction to the theory of using "air foil" sections (which create a laminar flow which tends to defeat aspiration and to drop air into the occupancy zone as discussed above).

There is another very nice feature about the Uni-Flo grille design. Not only does it provide for adjustment of horizontal flow, it also provides controlled adjustment in vertical planes. This permits you to steer the air past any obstacles in front of the grille.

Noise Levels

The effect upon noise level of the air turbulence created by Uni-Flo sidewall diffusers is sometimes asked about. Page 7 of Barber-Colman "Grille Engineering Data" contains a listing of noise levels for various air patterns. These figures speak for themselves, showing that there is no noise problem. Incidentally, Barber-Colman offers the most complete diffuser noise level data available, including the effect of dampers in various positions.

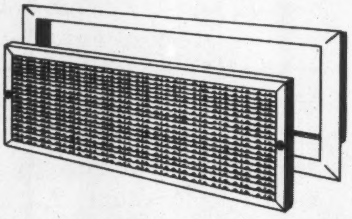


Fig. 4 Removable cores — to simplify installation and maintenance and contribute to good housekeeping.

Aspect Ratio

The aspect ratio of Uni-Flo grilles has a very definite effect on their performance, even though aspect ratio may not matter with other types of diffusers. It assists the excellent aspiration achieved by Uni-Flo diffusers and, therefore, assures more even air distribution throughout the room.

Another feature of Uni-Flo grilles is the removable core which contributes to good housekeeping. The core can be removed without damaging the paint seal around the frame. Also, electroplated cores are available (in

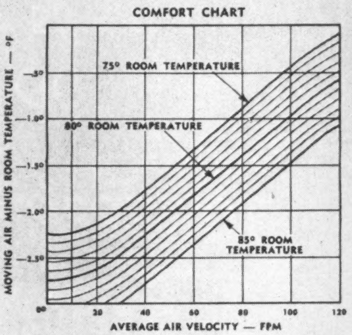


Fig. 3 Barber-Colman Comfort Chart — Here are the conditions of air movement and temperature in the occupancy zone that are required for human comfort standards. All points below the line represent uncomfortable conditions, while those above the line fulfill the requirements. You get required performance with Barber-Colman Uni-Flo sidewall diffusers.

which case the frames are painted to match the wall). Electroplated cores are less conspicuous and more durable and can be easily cleaned.

Accessories

Simple, positive, tamperproof adjustment of the air volume for easy system balancing is provided by the optional Uni-Flo opposed-blade volume control. Although normally key-operated, this can be furnished with an operating knob. Its opposed-blade design prevents any shifting in the damper setting. Deflectrols — factory-assembled deflecting vanes — attached to the rear of the diffuser provide uniform distribution across the diffuser face.

Performance

Barber-Colman diffusers will meet the following specification:

Sidewall and/or ceiling air distribution grilles and diffusers will diffuse air uniformly throughout the conditioned space, but at no point in the occupancy zone will the air velocity exceed 30 fpm at a temperature more than 2° F below the average room temperature or 75 fpm at a temperature more than 1½° F below the average room temperature.

Engineering Data Catalog No. F-4051-2 gives complete information, including 50 pages of selection data which provides all of the information necessary for even the most difficult jobs. Call your local Barber-Colman office or write to:

BARBER COLMAN

BARBER-COLMAN COMPANY

Dept. O, 1101 Rock Street, Rockford, Illinois

EQUIPMENT DEVELOPMENTS

Continued

where ample flexibility is available. Loads may be controlled with load sensitive control, position sensitive control, or temperatures sensitive control.

Oil Burner Nozzles . . .

. . . in package of 48 with strainers or filters in dustproof plastic containers—*Eddington Metal Specialty Co., Dept. HPAC, P. O. Box K, Eddington, Pa.*

Small tray holds assortment of strainers, filters, adaptors, or screw driver. Kit is 8¾ × 8½ × 1¾ in. Available with or without nozzles.

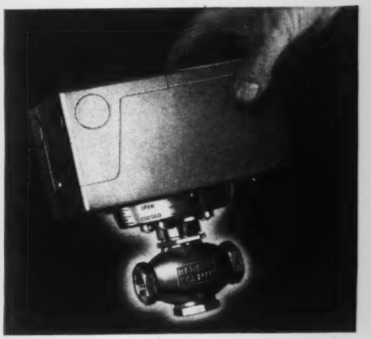
Air Compressors . . .

. . . developed from tests carried out by U. S. Army Corps of Engineers—*Champion Pneumatic Machinery Co., Dept. HPAC, 825 N. Pleasant St., Princeton, Ill.*

"Challenger" line of compressors available in 1 to 3 hp range with 5.1 to 12.25 cfm displacement. Motors, switches, controls, tanks are same as in other "Champion" models.

NOW . . .

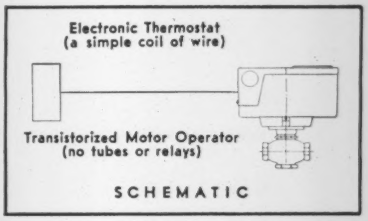
Electronic Control at no extra cost!



. . . new transistorized motor operator for proportional control!

The transistor operator is an electronically controlled device containing a transistorized amplifier and an operating mechanism for proportional operation of a valve (as shown) or damper.

Virtually self-contained, the attachment of a two-wire sensing element forms a complete electronic control system (see schematic). Wide choice of sensing elements.



Compactness, simplicity, and moderate cost are achieved through the use of transistors and electronic circuitry. This means superior performance and low maintenance.

Spring-return action provides fail-safe performance.

Ask for Brochure F8991

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Combination burners are available for the "OG-4," and are interchangeable with single fuel burners. All burners are of the same general construction; switching from dual fuel to a single fuel burner involves changing only one or two minor parts. On all burners the combustion air is pre-heated. "Push button" changeover from one fuel to another and electric gas ignition give added ease of operation and safety to the combination burners. Write today for the full story.

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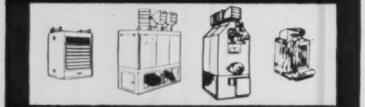

64,000 to 2,000,000 Btuh Units

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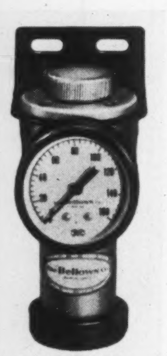
Title________

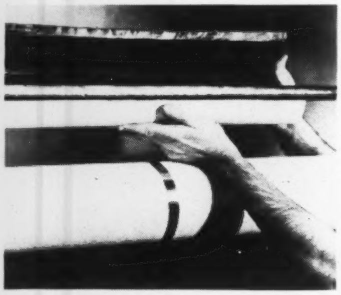
EQUIPMENT DEVELOPMENTS
Continued



Air Line Regulators . . .

. . . in relieving-type design—*Bellows Co., Dept. HPAC, Akron 9, Ohio.*

Built-in pressure relief valve allows increases in downstream pressure to "bleed" into atmosphere when such pressure exceeds regulator setting. Desired pressure setting made with regulator knob. For maintenance, chrome plated poppet valve stem may be removed from regulator, new assembly inserted without disturbing air line. Will operate on primary line operating pressures up to 250 psi. and will maintain downstream pressures of zero to 50 psi, zero to 125 psi, zero to 250 psi. Available in ¼ and ⅜ in. sizes.



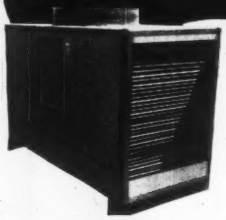
Piping Insulation . . .

. . . developed for hot and cold commercial piping applications—*Pittsburgh-Corning Corp., Dept. HPAC, One Gateway Center, Pittsburgh 22.*

Rigid cellular glass insulation available for temperature range of 35 to 350 F. "Foamglas" can be installed before or after hanging pipe. Manufactured in 24 in. sections and available in nominal thicknesses of 1, 1½ in. for steel pipe or copper tubing ranging ½ to 6 in. in size.

Do Your Specs Call for "WOOD COOLING TOWERS?"

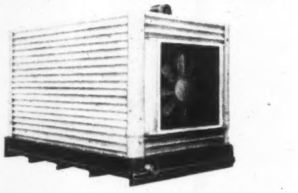
Marley Makes 'em All



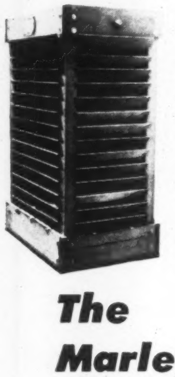
Marley Permatowers®

In addition to Marley's complete line of steel packaged cooling towers (see facing page), Marley makes a complete line of packaged wood towers for those jobs where unusually corrosive conditions are of paramount importance, and other models are the last word in first-cost economy.

Newest of the wood line is the PERMATOWER that sets a new standard of cooling tower durability through the liberal use of inert materials throughout. Double-Flow design principle makes them adaptable to restricted locations. WOOD FORCED-DRAFT AQUATOWERS, with durable redwood structures and asbestos cement board casings, are also long-lived towers and top discharge solves many location problems. SPRATOWERS combine engineered, plus-performance spray system and design simplicity for best natural draft cooling and rock bottom economy. Your Marley distributor can supply these products or complete application information.



Marley Wood Aquatowers®

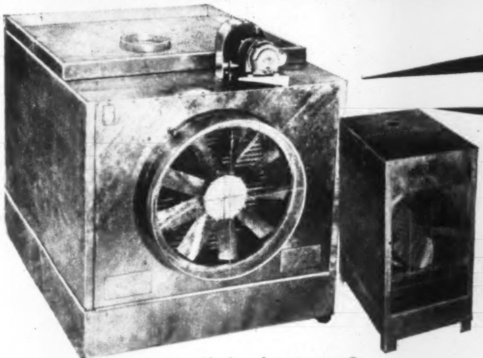


Marley SpraTowers®

The Marley Company

MA

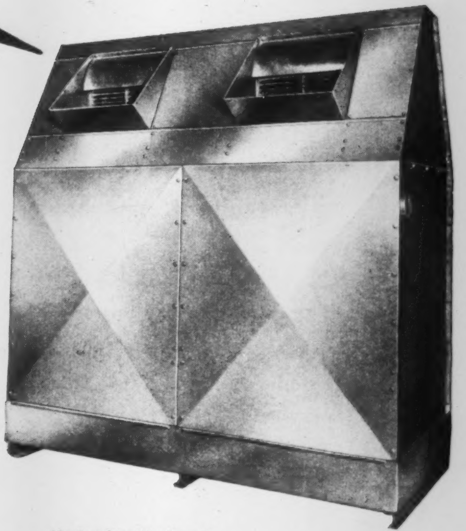
Do Your Specs Call for "STEEL COOLING TOWERS?"



Marley Aquatowers®

Marley Makes 'em All

(hot dip galvanized after fabrication)



Marley AquaCoolers®

MARLEY AQUATOWERS®

are the world's original and most popular steel packaged water cooling towers that offer user and contractor everything that spells *complete satisfaction*—performance, economy, minimum maintenance and lasting durability.

Fourteen models with capacities from three tons nominal and up permit selection of an Aquatower ideally suited for any specification. For larger capacity jobs, Marley offers twin Aquatowers served by a common cold water basin, that feature operational flexibility, permit "sensitive" cold water temperature control.

So, just name the time, the place, the gpm, and special installation requirements — your nearby Marley distributor will furnish a steel Aquatower that fits the job as though it had been custom-designed. All models feature Marley-designed mechanical equipment, lifetime wood filling, ease of disassembly (if necessary). Casings and multi-blade fans are hot dip galvanized after fabrication.

MARLEY AQUACOOLERS®

feature quiet operation, full performance and installation in minimum plan area, making them top choice for indoor service—and equally adaptable to location out of doors. AquaCoolers are simply and economically vented and their centrifugal blower fans provide operating pressures that overcome draft loss developed by ductwork.

Balanced spray system uses Marley non-clog nozzles that minimize maintenance. Engineered spray water break-up and ample depth of MarPak filling deliver air-water contact that means full performance in every capacity size.

Ten models, nominally from 5 tons and up, are available from your Marley distributor. Smaller models are shipped completely assembled; larger ones reach your job in two sub-assemblies that are readily bolted together. Heavy, braced casings, basins and fan scrolls are hot dip galvanized after fabrication.

RLEY

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Kansas City, Missouri

SOLID BAR
ALUMINUM WALL GRILLES
Independent "Fabrikated"
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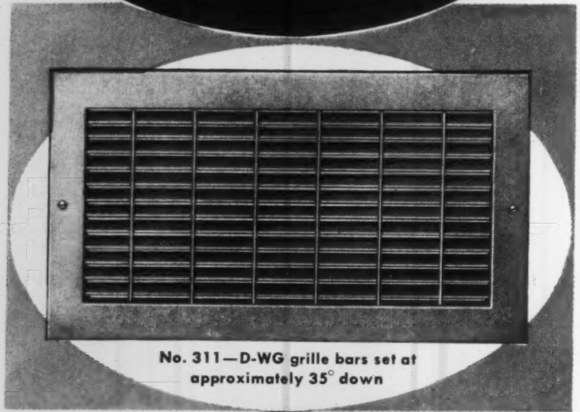
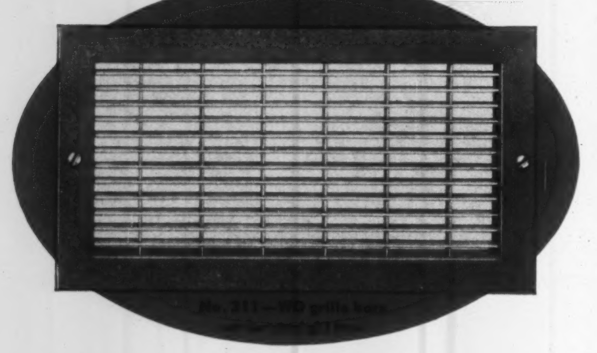
These wall grilles are famous "Fabrikated" construction but made from solid bar aluminum instead of steel.



No. 311—D-WG grille bars set at approximately 35° down



No. 311—WD grille bars [illegible]

In these grilles, the openings are $\frac{3}{8}$" x $1\frac{11}{16}$". Interior grille bars are $\frac{1}{2}$" deep. Outer rims up to vertical 12-inch sizes inclusive are $\frac{11}{16}$" wide beyond wall openings on all four sides. On sizes over 12-inch vertical, outer rims are $1\frac{5}{32}$" wide on all four sides beyond wall opening size. Approximate depth of all grilles is $\frac{3}{4}$". Narrower or wider rims available on special order at moderate additional cost.

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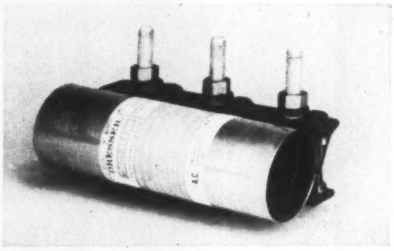
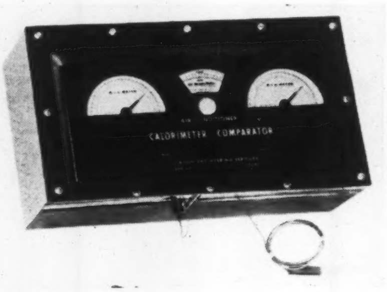


Pipe Repair Clamp . . .

. . . made of stainless steel and malleable iron lugs—*Dresser Mfg. Div., Dresser Industries, Inc., Dept. HPAC, 49 Fisher Ave., Bradford, Pa.*

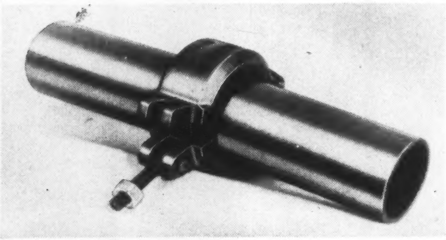
New "360" pipe repair clamp available for 2 and 3 in. pipe repair, can also be used as coupling. Special steel used in clamp bolts have yield strength of 40,000 psi, ultimate strength of 60,000 psi.



Portable Tester . . .

. . . for testing effectiveness of commercial air conditioners—*Liaison Engineering Services, Dept. HPAC, P. O. Box 5, Garland, Tex.*

"Calorimeter-Comparator" said to accurately indicate amount of heat removed by air conditioner in operation as well as total air volume. Unit establishes Btu per hr capacity of air conditioner under test in installed operating condition. Instrument weighs 6 lb, has overall dimensions of 16½ × 9 × 6½ in.

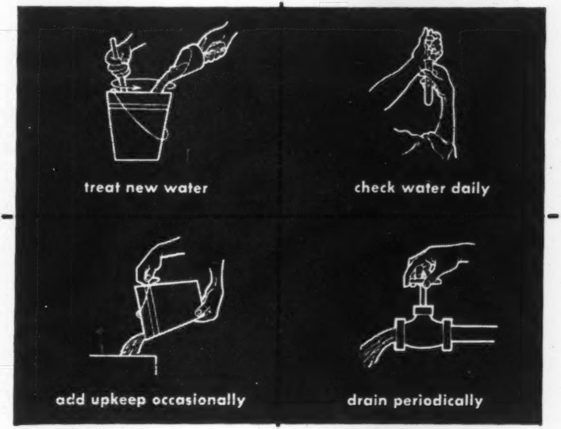


Swing Bolt Coupling . . .

. . . in design with safe locking device—*Charles E. Manning Co., Dept. HPAC, 4700 Clairton Blvd., Pittsburgh 36.*

Swing bolt coupling rated up to 500 lb working pressure. Available in 1, 2 3, 4 in. sizes.

SIMPLE – 4-step water treatment IMPROVES Air Conditioning



End scale, slime and corrosion troubles in air conditioning water with Oakite Airefiner No. 52. All it takes is a ten-minute daily check up by one man. This way you maintain high cooling efficiency and you reduce out-of-service time, too.

How? With a simple four step program. (1) Charge water initially with Oakite Airefiner No. 52. (2) Test water daily. (3) Add upkeep when necessary. (4) Drain system and replace with new, charged water on a periodic basis.

That's all there is to it. Airefiner No. 52 checks slime and algae growth, prevents scale build-up and minimizes corrosion. It leaves tubes clean for efficient heat exchange. It's safe. It's inexpensive.

For explanatory drawings and full details on this time and trouble saving method, ask your local Oakite Technical Service Representative, or write Oakite Products, Inc., 51A Rector Street, New York 6, N. Y.

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"Of Course I said **RIDGID** ... It's the only pipe wrench for my money. I've got work to do!"

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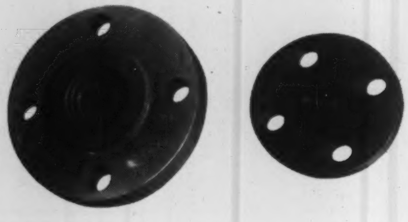
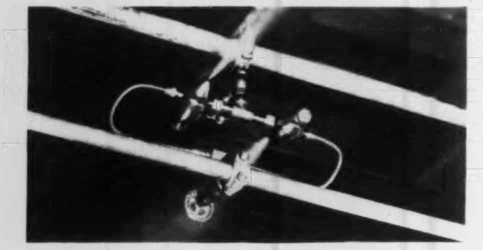


Plastic Flanges . . .

. . . with high burst, impact strength—*Carlon Products Corp., Dept. HPAC, P. O. Box 133, Aurora, Ohio.*

Center portion of PVC flanges can be tapped so single fitting can be used as reducing flange for several standard pipe sizes. Concentric ridges on face of flanges said to prevent slippage of gasket, consequent leakage. Though rated at 150 psi, fittings said to withstand higher pressure because of strength of material from which they are molded.



Atomizer . . .

. . . developed for straight humidification, evaporative cooling, split systems—*American Moistening Co., Dept. HPAC, Cleveland, N. C.*

"Amco Aero-Miser" atomizes water internally with minimum requirement of compressed air. Body is of brass construction, with hard bronze water nozzle, stainless steel for cleaning wire and neoprene coated nylon fabric for the control diagram. At each control operation cleaning wire cleans water jet. Available in standard capacities from 6 to 15 lb of water per hr.

Portable Grinders . . .

. . . designed for wide range of industrial operations, such as grinding, buffing and wire wheel work—*Thomas C. Wilson, Inc., Dept. HPAC, 21-11 44th Ave., Long Island City, N. Y.*

Various sizes, models of horizontal pneumatic grinders available with speeds ranging from 3100 to 12,000 rpm. Wheel sizes range from 3 to 8 in. in diam.

(*Continued on page 214*)

YOUR IDEAS WORK BETTER WHEN YOU WORK WITH HONEYWELL

THE FOLLOWING PAGES bring you some of the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 offices throughout the country; each staffed with control specialists to assist you in preparing proposals and writing specifications.

Look over these new products and systems. And, remember, they are backed by the kind of support only Honeywell can offer you.

Honeywell's control team gives best year-round air conditioning unit ventilator performance

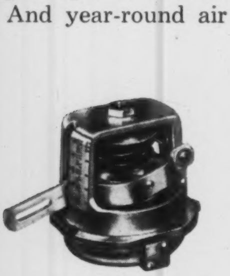
The Honeywell Pneumatic wall-mounted thermostat is the ideal way to control classroom temperatures. It senses temperatures the way the occupants do, gives exact temperature readings, delivers the exact temperature set. The Honeywell Pneumatic Round is more precise, responds faster than any other pneumatic thermostat on the market.

The Honeywell Unit Ventilator Control team reacts fast to level the temperature changes common to high-occupancy areas such as classrooms. Its air stream thermostat responds to temperature changes before they reach room occupants.

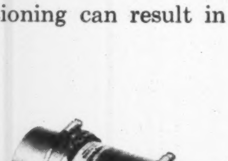
Developed especially for unit ventilators, this control team is ideal for year-round air conditioning using unit ventilators.

And year-round air conditioning can result in real savings for a school in the cost of construction, real benefits in increased teacher and student efficiency. It also brings the community a public building which can be used year-round, providing more useability for every building dollar.

For more information about the Honeywell Unit Ventilator Team or about the Economic Benefits of Air Conditioning for Schools, write Minneapolis-Honeywell, Dept. AC-3-50, Minneapolis 8, Minn.

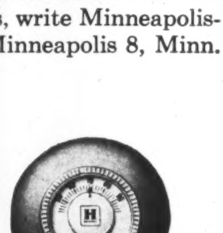


M5016 Damper Motor controls unit ventilator damper. Diaphragm construction reduces friction, provides smooth positioning, aids modulating action of the entire Honeywell control team.



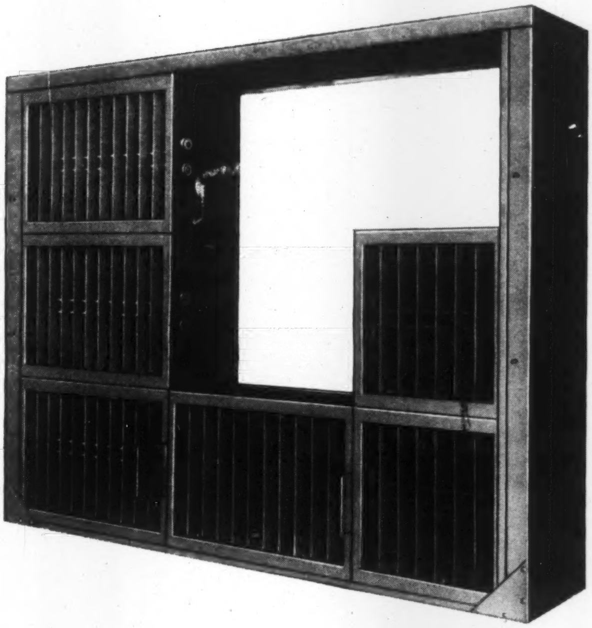
M0903 Piston Motor regulates Unit Ventilator coil bypass damper in accordance with summer or winter demands. Direct drive gives smooth modulation throughout damper travel.

L0907 Air Stream Thermostat has fast response, fewer moving parts. Working with room thermostat it resets the air temperature delivered by the ventilator, helps provide constant, even temperature.



T0913A Summer-Winter Pneumatic Round gives exact temperature reading, delivers exact temperature set. Responds instantly. Precise, rugged, tamper-proof, easy to install, see and set.

Your choice of design in Honeywell's New Electronic Air Cleaner Line!



This Selector Series of Electronic Air Cleaners now offers you a choice of three cell designs to match exact job requirements.

Hi Velocity Cell $\frac{1}{4}$ inch plate interval. Provides air cleaning efficiency of 95 per cent at an air velocity of 700 fpm. Specify when maximum cleaning is desired, when high velocities are encountered, or where installation space is limited.

AC/ME Cell $\frac{5}{16}$ inch plate interval. Offers advanced capacity for dirt loading and maximum cleaning efficiency at moderate air flow rates. Ninety per cent efficient at 600 fpm.

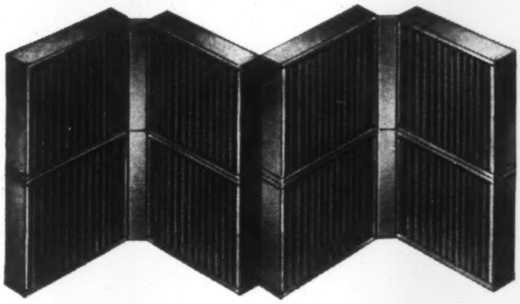
Hi-Load Cell $\frac{3}{8}$ inch plate interval. Provides greater capacity for dirt loading, less frequent washing. 90 per cent efficient at 420 fpm.

Six times more efficient than mechanical filters, Honeywell Electronic Air Cleaners eliminate airborne dirt from the air conditioning system, trapping particles even as small as .001 microns.

A completely new washer has pliable nozzles that flutter as the water passes through giving faster, more efficient washing.

All Honeywell Electronic Air Cleaners are designed in building block modules. The frame is eliminated on field assembled units and simple button-type connectors replace the old electrical connections. They offer the simplest, quickest installation available, will fit an air conditioning system of any size.

For the ultimate in pure air, specify Honeywell Activated Charcoal Filters with your Electronic Air Cleaner

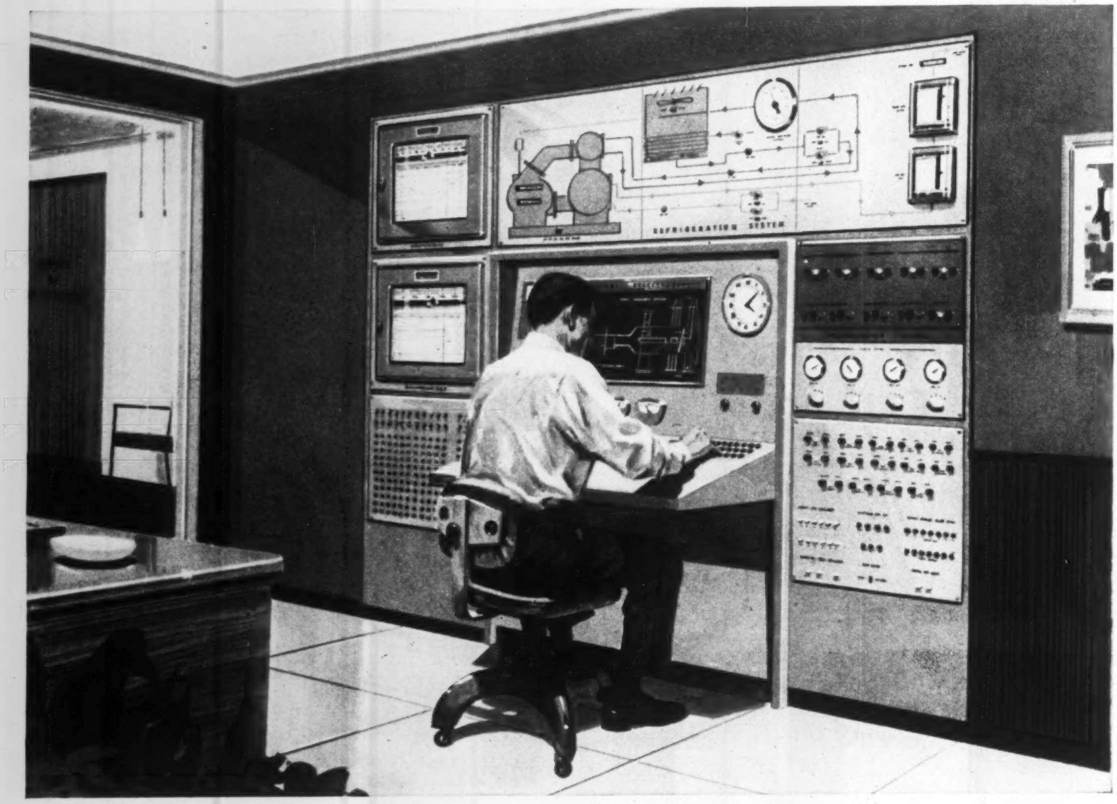


Add Honeywell Activated Charcoal Filters to your Electronic Air Cleaner and you have the finest air cleaning system available. The Electronic Air Cleaner removes the dirt. The Activated Charcoal Filters remove the odors. And they help each other do a better job. For instance, the Electronic Air Cleaner, by removing dirt efficiently, prevents the charcoal filter pores from becoming clogged. They last longer without reactivation, work better.

Activated Charcoal Filters pay for themselves in reduced air conditioning costs because they reduce the amount of outdoor air required to dilute odor. And with Honeywell's new V-shaped arrangement of building block modules, more charcoal filters can be put into the air stream without sacrificing easy access for reactivation.

For more information about Honeywell Electronic Air Cleaners or Activated Charcoal Filters, call your local Honeywell office. Or write Honeywell, Dept. AC-3-50, Minneapolis 8, Minnesota.

Honeywell's New Selectographic DataCenter* uses floor plan and system projection for more compact installation!



It makes centralized control easier to design, install and operate.

Now an air-conditioning engineer can "see" up to 50 separate fan system diagrams and floor plans, read and adjust critical temperatures throughout a multi-story building . . . all at one console.

Here's additional savings added to centralized control. For Honeywell's selectographic design saves time, saves space, saves on extra construction. And it's an attractive addition to any building.

And Honeywell's modular building block design brings the system greater economy, new flexibility. Starting with the basic unit—the central Selectographic Console—other modules of a standard 2′ by 2′ dimension may be added as the need arises or as budget permits. Honeywell's Selectographic Supervisory DataCenter can be installed in buildings of all sizes, for all purposes—can grow with the structure itself.

For more information about this panel, call your local Honeywell office. Or write Honeywell, Dept. AC-3-50, Minneapolis 8, Minn.

FOR MORE TO WORK WITH WORK WITH HONEYWELL

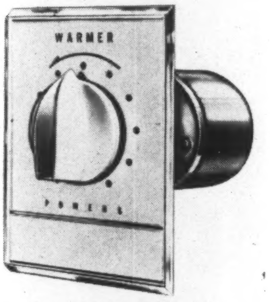
Honeywell

**Trademark*

H HONEYWELL *First in Control*

EQUIPMENT DEVELOPMENTS

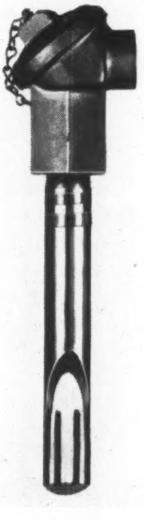
Continued from page 210



Positioning Switch . . .

. . .designed to eliminate lag in control action—*Powers Regulator Co., Dept. HPAC,* 3434 *Oakton St., Skokie, Ill.*

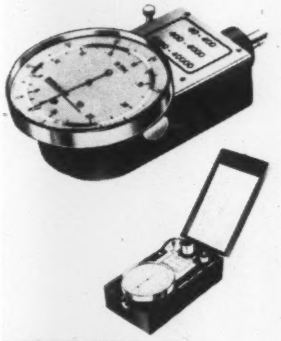
Intended primarily for use with remote control of pneumatic valves or motors, such as on dampers in ducts. Turning switch knob gradually increases, decreases flow of compressed air to devices, opening or closing them to desired position. Unit measures $2\frac{3}{8} \times 3\frac{3}{8} \times 2\frac{1}{4}$ in. Available for flush or surface mounting. Body air connections are for 1/16 in. NPT.



Industrial Thermocouple . .

. . .in new heavy duty design—*E. C. Smith Mfg. Co., Dept. HPAC, Forrest and Hector Sts., Conshohocken, Pa.*

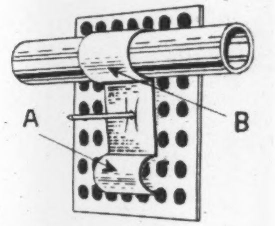
"PermaKouple" consists of heavy protecting tube containing two No. 8 gage wires embedded in solid aluminum oxide ceramic insulation, designed to prevent corrosion or scaling of wires and is said to eliminate flash fires in case of burn-through. Unit said to remain straight, rigid for indefinite period in temperatures to 2200 F. Available in 20 ft lengths or as complete thermocouple assemblies for $\frac{1}{2}$, $\frac{3}{4}$, and 1 in. standard pipe diameters.



Tachometers . . .

. . .provides accuracy to ±0.5 percent—*Boulin Instrument Corp., Dept. HPAC,* 10 *First St., Pelham, N. Y.*

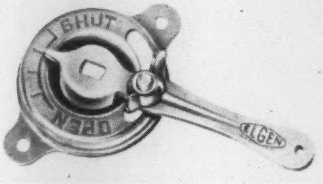
Reflecting mirror on dial parallax intended to eliminate errors. Pointer rotates 675 deg providing scale length of $13\frac{1}{2}$ in. with dial of $2\frac{7}{8}$ in. diam. Available in three ranges. "Tri-Tach" measures from 40 to 40,000 rpm or 20 to 20,000 fpm. Unit weighs 12 oz.



Tubing Clip . . .

. . .added to company's line—*Stic-Klip Mfg. Co., Dept. HPAC,* 500 *Regent St., Cambridge* 40, *Mass.*

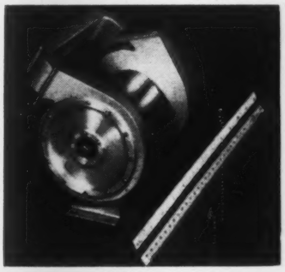
New tubing spring clip enables use of four sizes of larger diameter tubing, cable, or hose. Said to eliminate surface drilling or hole punching in metal or masonry surfaces. Maximum tested holding strength per clip is 75 lb.



Damper Sets . . .

. . . in design developed to prevent rattles, air leakage—*Elgen Mfg. Corp., Regulator Div., Dept. HPAC,* 32-49 *Gale Ave., Long Island City* 1, *N. Y.*

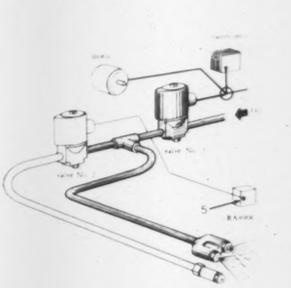
Damper sets constructed of heavy gage cadmium plated metal in range of sizes from $\frac{1}{4}$ in. damper regulator sets to $\frac{1}{2}$ in. quadrant damper regulator sets for positive control in small dampers or in heavy duty heating, ventilating, and exhaust systems. Can be mounted on round or flat surfaces.



Centrifugal Blowers . . .

. . .in miniature twin blower design—*Sawyer-Bailey Corp., Dept. HPAC,* 1559 *Niagara St., Buffalo* 13, *N. Y.*

Miniature "Series 300" centrifugal blowers said to give high efficiency at extremely low flow rates. Blower generates static pressures up to 55 in. water gage with a flow of 7 to 20 cfm. A 1/10 hp 400 cycle a-c or 12 and/or 24 volt d-c motor drive the twin blowers.



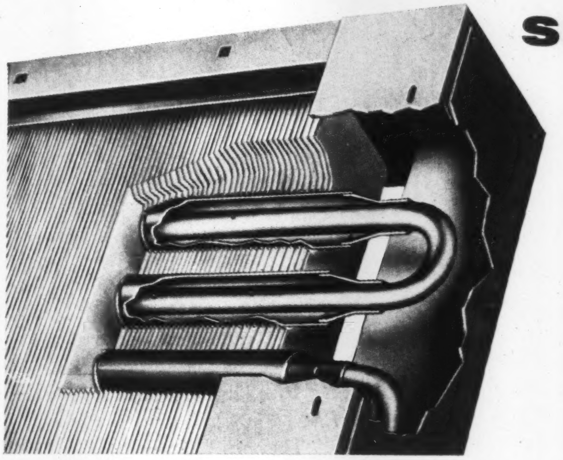
Oil Ignition System . . .

. . .in two stage design—*Nu-Way Corp., Dept. HPAC,* 2416 *Fourth*

NO "FAHRENHEIT FADEOUT"

with Nesbitt

SERIES T SURFACE

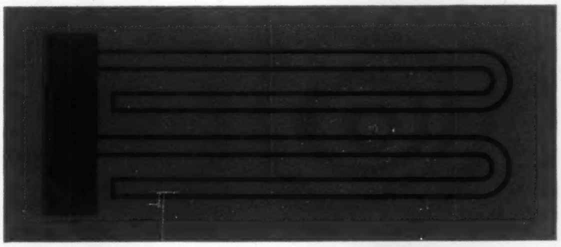


Exclusive Trombone Design provides uniform discharge temperature and maximum freeze protection

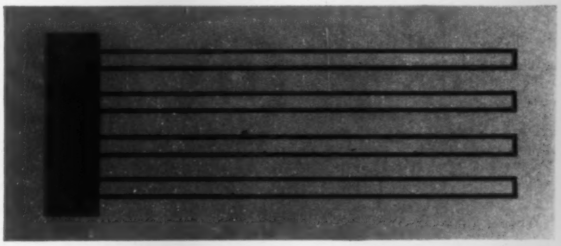
Nesbitt Series T Heating Surface employs a unique principle by which you can achieve uniformity of steam distribution unmatched by conventional arrangements. It is ideally suited to applications requiring direct preheating of outdoor air, or where uniform discharge temperature under throttled control is important.

The trombone-like design delivers steam continuously to adjacent pairs of condensing tubes—doubles the area over which small steam quantities are distributed . . . prevents freeze-up.

Get complete details on capacities and application data now. Write for Nesbitt Publication 305-1.



In Series T design, steam traverses full length of tube, even under modulated conditions. This design prevents "back up" or heat fadeout. Note single connection to supply header for each pair of tubes.



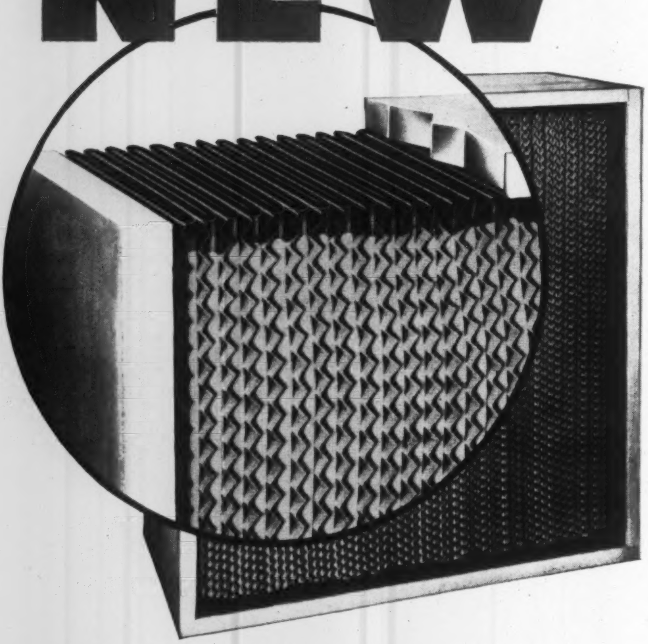
In conventional arrangements, the same steam quantity under throttled control travels only half as far along surface length. Steam fades out toward end of tubes. And there are twice as many connections to the supply header.

Nesbitt

HEATING SURFACE WITH THE TROMBONE STEAM DISTRIBUTING TUBES

Made and sold by John J. Nesbitt, Inc., Phila. 36, Pa.

NEW



MICRETAIN Series
ABSOLUTE® Filter

—Initial Pressure Drop 0.4″ w.g.
—Efficiency 95% DOP Test
99% NBS Method

With an efficiency of 95% on 0.3 micron particles and of 99% by the discoloration test using atmospheric dust, the new MICRETAIN series of ABSOLUTE filters offers extremely high efficiency at an initial pressure drop of only 0.4″ w.g. Life tests to a final pressure drop of 1.0″, using 100% outside air and without prefilters, show a service life of at least 4000 hours.

Using a chip board frame, a special new glass-asbestos filter medium and sturdy Kraft separators, the new MICRETAIN Model 7A-1000 filter packs a capacity of 1000 CFM into a face area of 24″ x 24″, with a filter depth of 11½″. Self-supporting – no frame required.

Ideal for hospital operating room supply systems, the MICRETAIN filter is 97% efficient in removing nebulized staphylococcus aerosols, and essentially 100% efficient in removing bacteria attached to dust particles.

Special materials available for high temperature, high humidity, and fire and corrosion resistance.

Write for Bulletin 142

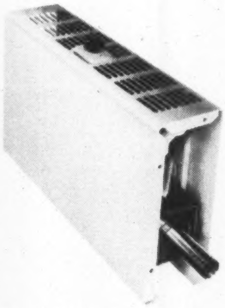
Cambridge Filter Corporation
732 E. Erie Blvd., Syracuse 1, N. Y.

Pioneers in High Efficiency Air Cleaning

REPRESENTATIVES IN PRINCIPAL CITIES

Ave., Rock Island, Ill.

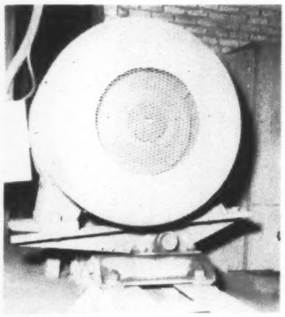
"D-Lay-Flo" oil ignition system uses light oil at input rates to 40 gph; admits only 2/3 of oil flow during initial firing. When flame is established after 15 sec, photoelectric cell triggers valve on extension of oil line and burner operates at set capacity.



Finned Tube Cover . . .

. . . intended for institutional, industrial, commercial applications—*Kritzer Radiant Coils, Inc., Dept. HPAC, 325 N. River St., Batavia, Ill.*

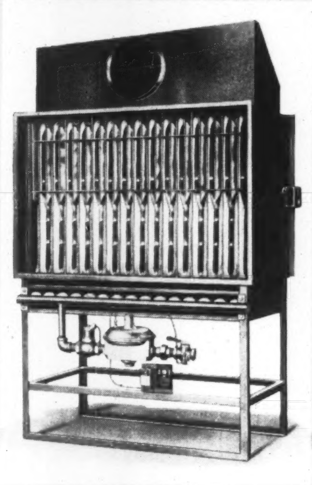
"Thermosil" finned tube covers are 13, 14, 20, 24 in. high with vandal-proof louvers in top only, or top and front. Coils of heavy steel pressure tube with steel fins, or copper tube with aluminum fins, are supported on 12 gage steel channel brackets and adjustable stirrups. Coils ride on sliding shoes for silent operation during heating, cooling cycles.



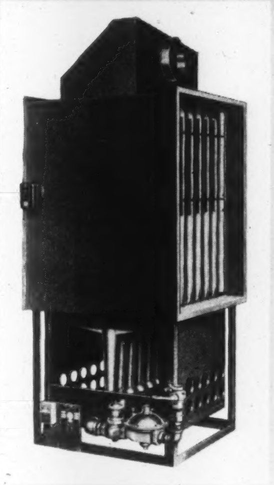
Motor Bases . . .

. . . designed to improve belt drive performance—*Murray Equipment Co., Inc., Dept. HPAC, 14011 Oakland Ave., Detroit 3.*

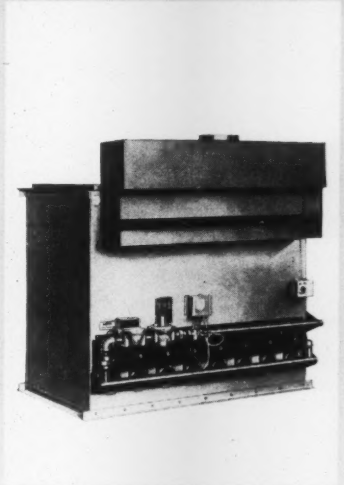
HAYES STAINLESS STEEL HEAT EXCHANGERS



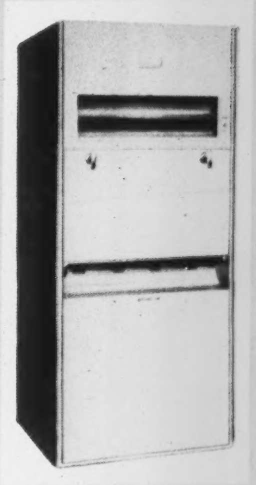
SED-E



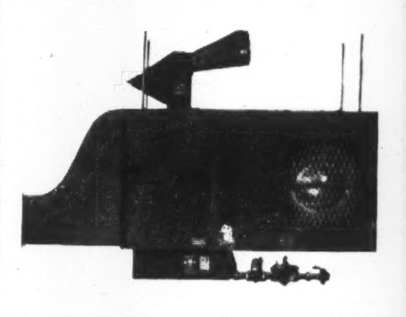
SED-S



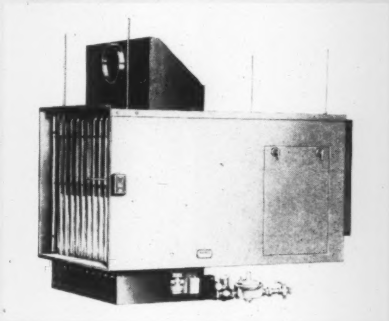
SED-VF



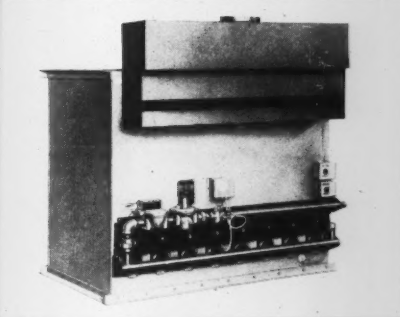
SEC



SEU



SES



SED-CF

SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation down-stream of cooling equipment, for continuous blower operation. Air through-put in either direction. 45,000 to 675,000 Btu input.

SED-S — Same as SED-E except controls are at the side. Either SED-E or SED-S is available in sizes from 45,000 to 675,000 Btu input in increments of 45,000 Btu.

SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. 7 sizes from 70,000 to 280,000 Btu input.

SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower. 7 sizes — 70,000 to 245,000 Btu input. For zero clearance.

SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 480,000 Btu input.

SES — Forced air, suspended furnace for installation in suspended duct system. Designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

SED-CF — Tested and approved as a duct furnace for counterflow. Recirculating fresh air thru the top. Has a built-in bypass. Sizes from 70,000 to 280,000 Btu input.

—*REPRESENTATIVES EVERYWHERE*—

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CALIFORNIA:
SAN FRANCISCO: John Rhoads
SAN JOSE: Central Service Co., Inc.
VISALIA: Valesco, Inc.
COLORADO:
DENVER: McCombs Supply Co.
FLORIDA:
CLEARWATER: R. J. Clark Equipment Co.
GEORGIA:
ATLANTA: R. E. Holcome; Dealers Supply Co.
IDAHO:
BOISE: Mechanical Equipment Co.
IOWA:
DUBUQUE: McDonald Mfg. Co.
KANSAS:
WICHITA: O'Connor-Oklahoma Co.
MISSOURI:
KANSAS CITY: Smith Steam Specialty Co.
NEW JERSEY:
PASSAIC: M. Blazer & Son
NEW MEXICO:
ALBUQUERQUE: Boyd Engineering Co.
OKLAHOMA:
OKLAHOMA CITY: O'Connor-Oklahoma Co.
TULSA: O'Connor-Oklahoma Co.
OREGON:
PORTLAND: Temp Control Corp.
TENNESSEE:
NASHVILLE: Reube O. Emery
TEXAS:
AUSTIN: Deudecke Engineering Co.
EL PASO: Boyd Engineering Co.
LUBBOCK: Nunn Electric Co.
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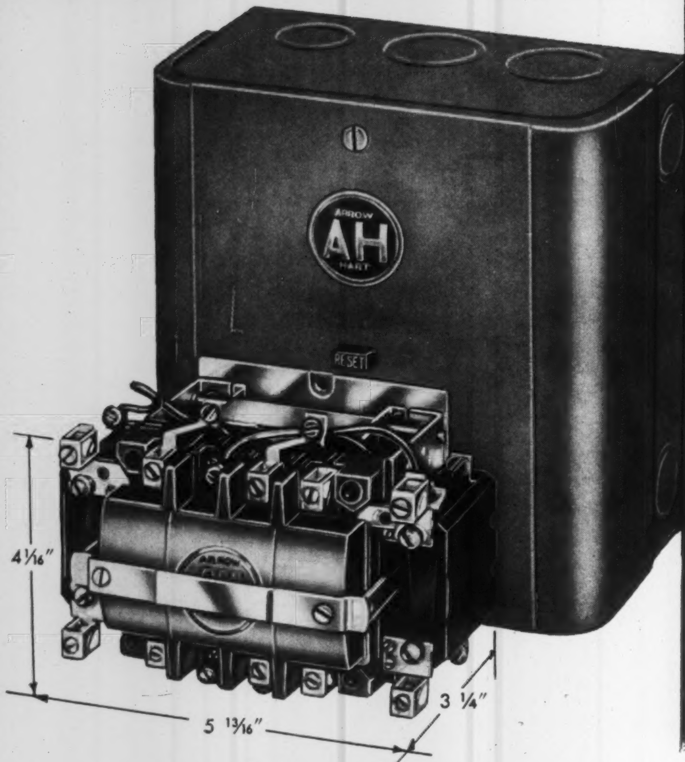


1/2 THE SIZE OF CONVENTIONAL STARTERS

NEW MODEL 58 "RA" STARTERS

Featuring the exclusive Arrow-Hart "Right Angle" Mechanism, with the magnet operating through a simple bellcrank lever. The resulting mechanical advantage lets a smaller, lighter magnet outperform older, direct-acting types — makes it possible to cut starter size in half while improving performance. Easily placed in equipment cavities or on crowded panels, these compact starters help solve design problems and pack top performance into small space. Other important "RA" features include:

- **NEW WIDE VOLTAGE RANGE COILS**... for Sizes 0, 1 and 2, with 1 coil now replacing 3 of the older type. STANDARD COIL VOLTAGES: 110-120, 208 230, 440-480, 550-600 VAC, at 60 cycles. New epoxy resin encased coils afford better protection against abuse and environmental conditions.
- **SIMPLE INSTALLATION AND MAINTENANCE**... with straight-thru front wiring, easy contact accessibility, and new wrap-around enclosures for Size 1.
- **A COMPLETE LINE**... including Sizes 0 through 5.

Write today for your free copy of Catalog 14: Arrow-Hart & Hegeman Electric Co., Dept. HPAC, 103 Hawthorn St., Hartford 6, Conn.

- **Have you seen Arrow-Hart's new 30 and 50 amp, 250 V, 4-wire grounding receptacles?**

ARROW AH HART

Quality since 1890

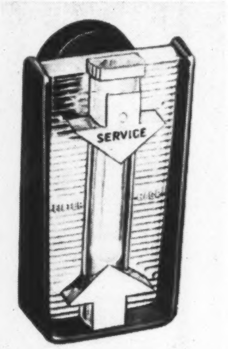
MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES

ARROW AH HART

EQUIPMENT DEVELOPMENTS

Continued

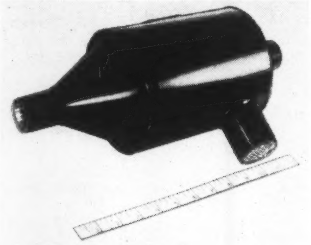
"Tens-A-Matic" bases designed to match tension to load by maintaining alignment, eliminating belt slip, giving automatic takeup. Available for sizes 1 through 200 hp motors.



Filter Gage . . .

...designed to indicate gradual clogging of filter, exact time when change or service should be made—*F. W. Dwyer Mfg. Co., Dept. HPAC, P. O. Box* 373, *Michigan City, Ind.*

Plastic filter gage actuated by differential or drop between atmospheric and blower compartment pressures. Three different capacities said to fit all types, sizes of furnaces, air conditioning systems, etc.



Moisture Separator . . .

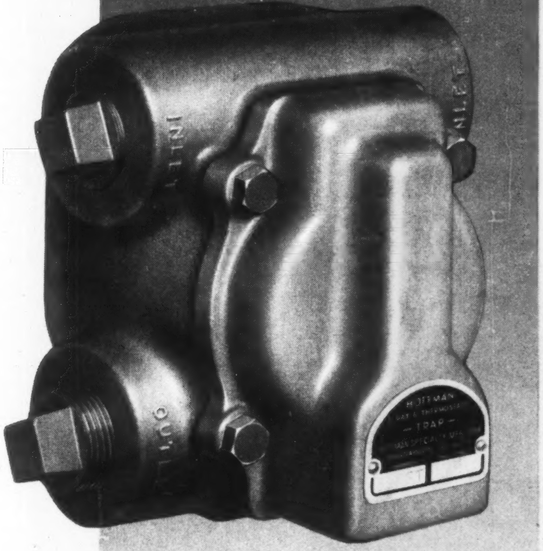
...without moving parts—*South Wind Div., Stewart-Warner Corp., Dept. HPAC,* 1826 *Diversey Pkwy., Chicago* 14.

Moisture separator said to remove from 97 to 100 percent of free moisture from gas stream, regardless of attitude, altitude, or environment. Recommended by manufacturer for applications with fluids such as alcohol, ammonia, refrigerant No. 12, and to some degree, oils.

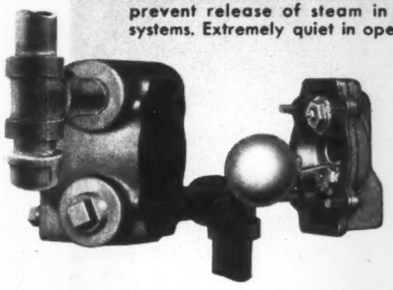
HOFFMAN STEAM *Complete line of* SPECIALTIES

Again Hoffman provides industry with an improved product, refined to function more effectively and economically in removing condensate. The new 50 Series Float and Thermostatic Trap has an integral thermostatic air by-pass consisting of thermal element, seat, and cage, factory set and sealed assuring dependable service and easy maintenance.

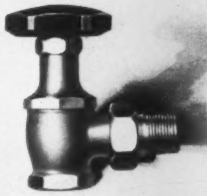
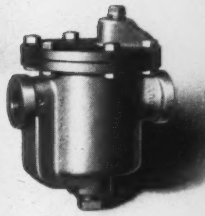
Hoffman engineers thus anticipate industrial steam heating trends that demand less maintenance and operating costs.

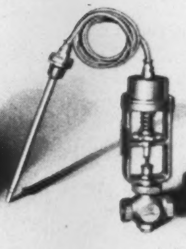


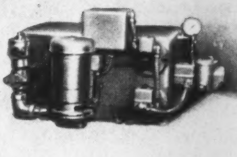
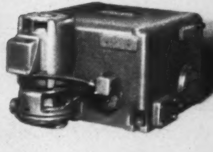
50 SERIES F & T TRAP
To release condensate and air and to prevent release of steam in steam systems. Extremely quiet in operation.



All working parts of the 50 Series Trap are mounted on the removable cover so that it is not necessary to break pipe connections for cleaning or repairing.



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HOFFMAN

SPECIALTY MFG. CORP.
1700 West 10th Street, Indianapolis 7, Indiana
VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING SYSTEMS, STOCKED AND SOLD BY LEADING WHOLESALERS OF HEATING AND PLUMBING EQUIPMENT.

Fitzgibbons

NEW
PACKAGED BOILERS

Three NEW lines for 1959 of factory assembled and tested packaged forced draft boiler-burner units. All oils—oil and gas combination—and all gas units offer the utmost in design and performance for any modern heating application.

Features include: Full wet-back and sides (no rear wall refractory); pressurized smokebox; A.S.M.E. construction; butt heads with full fillet welds; efficiency more than 80%.

Sizes up to 464 horsepower guaranteed rating; steam, hot water and hot water supply. **• Write today for new catalogs.**

THE FITZGIBBONS BOILER COMPANY, INC.

MOST ECONOMICAL IN FUEL · 1886 · THE FITZGIBBONS BOILER

New York Sales and Executive Office: 101 Park Avenue, New York 17, N.Y.
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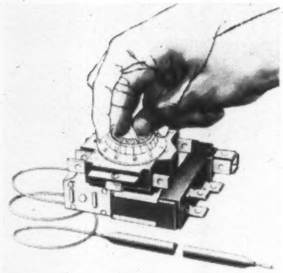
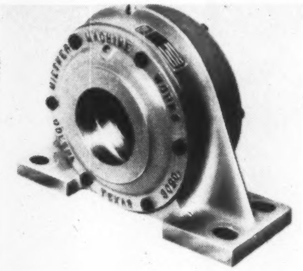


Cycling Thermostats . . .

. . . designed to provide shallow depth mounting and side access to terminals —*Ranco Inc., Dept. HPAC, 601 W. Fifth Ave., Columbus, Ohio.*

"C21" and "C22" designed to operate air conditioners, compressors, strip heaters, reverse-cycle heat pumps under cross ambient conditions in wide range of applications. "C21" thermostat available as thermostat alone or with new manual rotary circuit selector switch to provide up to four circuits for operation of compressors or heaters. Rated at 20 amp: full load, 78 amp locked rotor at 115/230 volts a-c; 20 amp at 250 volts a-c non-inductive.



Pillow Blocks . . .

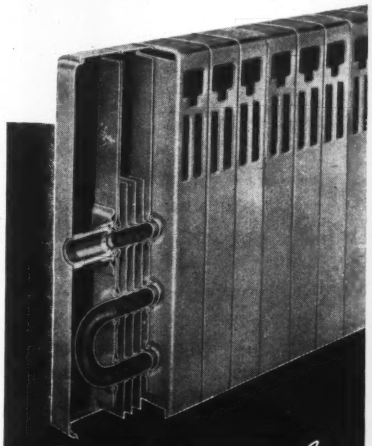
. . . designed to accommodate all series of spherical roller bearings—*Miether Machine Works, Dept. HP-AC, P. O. Box 3907, Odessa, Tex.*

Twenty basic housings will accommodate 94 separate bearings, says manufacturer. Housings take as many as eight different bearing sizes and up to 11 separate shaft diameters. Housings are center-grooved for universal center lubrication. Pillow blocks have interchangeable end caps with second connection for side lubrication. Labyrinth closures or oil seals available on most caps.

2 kinds of heat

RADIANT and CONVECTED

from SHAW RADIATORS



always *properly* distributed in the room!

Shaw Radiators "heat-condition" a room for *natural* comfort by delivering *radiant* heat that warms solid objects, and *convected* heat to warm the atmosphere.

This AIR-e-ATED Radiant Heat, exclusively Shaw's, is distributed in unvarying, health-guarding proportions that only Nature—*at her best*—can rival.

AIR-e-ATED Radiant Heat is the result of Shaw's fully self-contained construction, featuring full length steel heating fins and exterior radiant panels *all tightly bonded to the copper heating coils.* Shaw units—panel or baseboard—are but 3" thick, easily handled and installed. Choice of same end or opposite end tapping permits simplified piping, lower piping costs. Hot water or steam may be used up to 150 psi.

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SP-17

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201 EAST CARSON ST., PITTSBURGH 19, PA.

Life in these excited states...

I.N. DUTCH CHEMICAL CO.
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ACE-ITE
all-purpose toughie

High-impact, rubber-plastic, most economical for average chemicals. ½ to 6". Screw or solvent welded fittings. Valves ½ to 2". NSF-approved. *Bul. 80A.*

ODD SHAPES?
you make...we line

Rubber or plastic lining is economical life insurance for costly "special" equipment. It's a specialty with ACE. Write for *Bul. CE-53.*

PLASTIC VALVES
for matched systems

Choice of Rivi-clor PVC, Ace-Ite rubber-plastic, Ace polyethylene or Ace Saran to match *any* plastic pipe. Sizes ½ to 2". Also larger plastic-lined valves.

An easier way to put corrosion under your thumb

Specify the equipment that's engineered to stay on the job under the toughest corrosive service . . . *Ace* equipment by American Hard Rubber Company. Now nine kinds of plastic and rubber pipe, plus pumps, valves, tanks, and special equipment to solve any corrosion or contamination problem.

PACHYDERMOUS PAIL

Ace-Hide, tough as a rhinoceros, insensitive to corrosives, makes this finest of acid pails. Also dippers, bottles, funnels, etc.

See our pages in cec Catalog!

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
DIVISION OF AMERACE CORPORATION
Ace Road • Butler, New Jersey

CHECK *the Advantages of* GOODALL *Rubber* EXPANSION JOINTS

Goodall Expansion Joints have not only the advantages stemming from the natural characteristics of rubber for all types of installations, but, what's more important, they have back of them Goodall's engineering skill, manufacturing experience and reputation for quality that give *added* assurance of exceptional service under all conditions.

EASIER TO INSTALL...

Goodall Rubber Expansion Joints are quickly, easily installed on new construction or as replacements. They are light in weight to facilitate handling, with short face-to-face dimensions for easier application where space is limited. Retaining rings are quickly aligned and bolted. No gaskets are required.

RESPONSIVE TO MINIMUM PRESSURE...

With Goodall Rubber Expansion Joints only the slightest pressure is required to create movement in any direction. Result—stress on metal pipe or other member is eliminated or, at most, reduced to an absolute minimum.

MANY SIZES...HIGH WORKING PRESSURES...

Goodall Rubber Expansion Joints are available in sizes from 3/8" to 96" I.D., in all required styles and constructions. Working pressures range up to 125 P.S.I. for Pressure Joints, and to 90 P.S.I. for Vacuum-Pressure Joints, depending on size.

LONGER SERVICE LIFE...

Goodall Rubber Expansion Joints last longer in service because of inherent characteristics of the material from which they are made. There is no embrittlement... continuous movement (flexing) actually keeps the rubber joint "alive". There is no corrosion or electrolysis. Resistance to abrasion is exceptionally high. Replacement costs are lower.

"If it's GOODALL, it MUST be Good"

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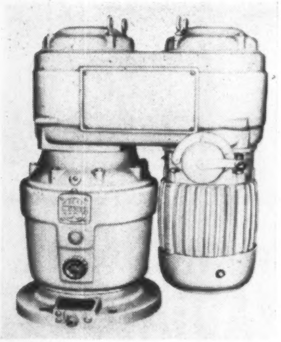
EQUIPMENT DEVELOPMENTS

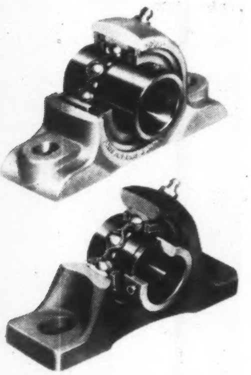
Continued



Variable Speed Drive . . .

. . .designed especially for agitators and mixer duty—*U.S. Electrical Motors, Inc., Dept. HPAC, Box 2058 Terminal Annex, Los Angeles* 54.

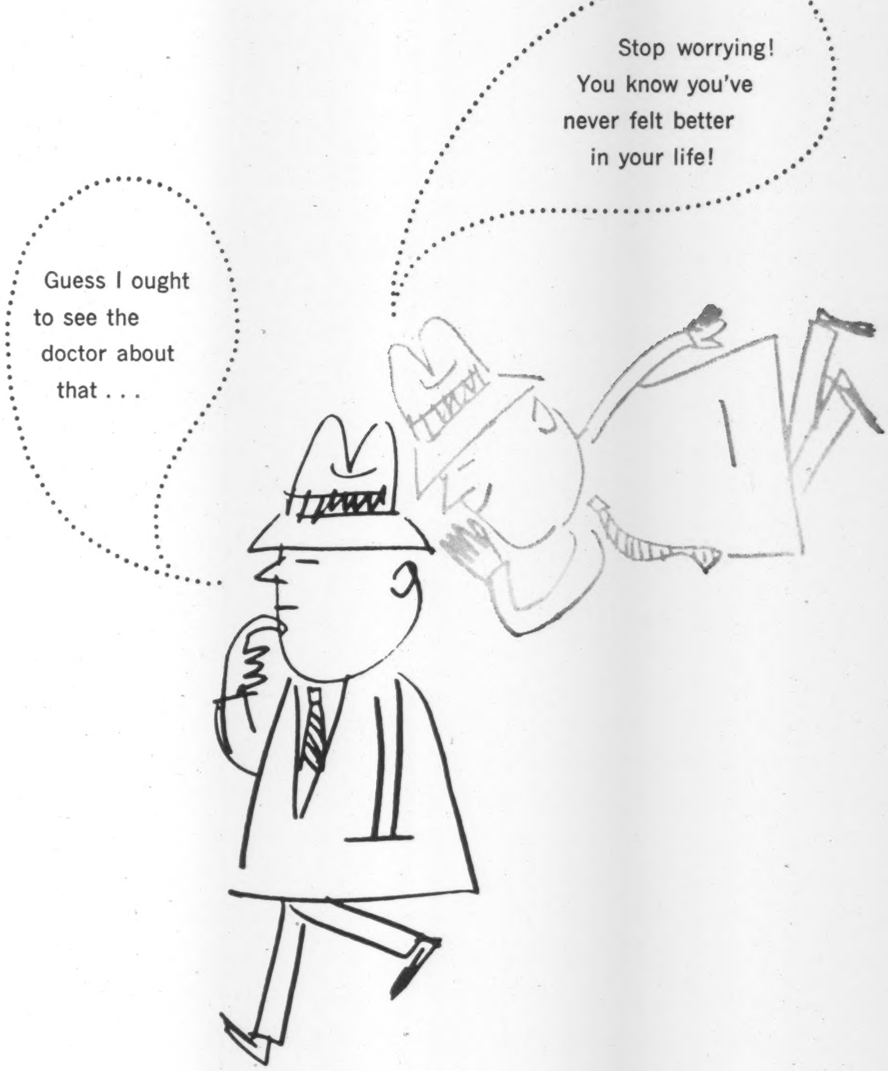
"Vertical Varidrive-Syncrogear" variable speed drive unit combines mechanical type variable speed transmission and double reduction gearing. Contains no electronic or d-c components and connects to 3-phase a-c power source. Several methods of speed control available. Sizes range 3 to 30 hp with speed variations from 2:1 to 7:1 with 30 to 380 rpm.



Pillow Block Bearings . . .

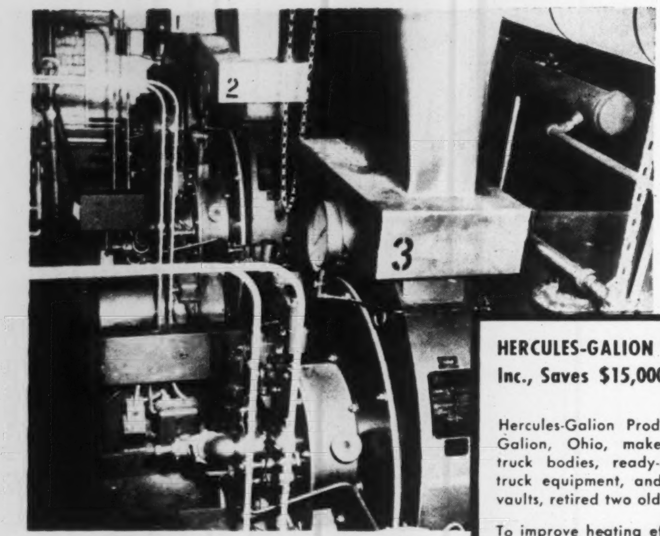
. . .in design with shock-resistant, ductile housings—*Hoover Ball and Bearing Co., Dept. HPAC,* 5400 *South State Rd., Ann Arbor, Mich.*

Pillow block bearings, companion flange bearings designed to carry light loads at normal speeds. Pillow block units available in shaft sizes 1/2 through 1-3/16 in. Units with heavy cast iron housings for normal duty available in shaft sizes 3/4 through 2-15/16 in.


Guess I ought to see the doctor about that . . .
Stop worrying! You know you've never felt better in your life!

Don't be your own worst enemy! If you notice one of cancer's danger signals in yourself, don't talk yourself into thinking it's nothing to worry about. See your doctor. Only **he** can tell. To learn the seven danger signals and to find out how to guard yourself against cancer, call our nearest office or just write to "Cancer," in care of your local post office.

AMERICAN CANCER SOCIETY



HERCULES-GALION PRODUCTS, Inc., Saves $15,000 Per Year!

Hercules-Galion Products, Inc., of Galion, Ohio, makers of dump truck bodies, ready-mix concrete truck equipment, and steel burial vaults, retired two old style boilers.

To improve heating efficiency, they installed three Cyclotherm 125 h.p. combination light oil/gas package steam generators. The total savings per year comes to $15,000.

As growing production or expanding plant facilities require more steam, Cyclotherms can be added when needed.

CYCLOTHERM

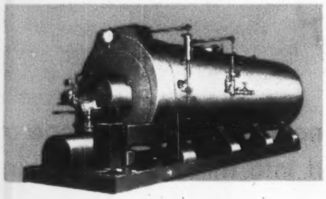
Steam capacity that grows with the plant!

When you recommend Cyclotherm Steam Generators you recommend a steam source that can be quickly and economically expanded to meet plant expansion. For Cyclotherm's wide range of capacities permits the addition of exactly as much new capacity as may be needed at any time. Will 518 lbs. of steam per hr. suit the requirements? That's what a 15 HP Cyclotherm produces. Or are 25,875 more steam lbs. per hour wanted? In that case, a 750 HP Cyclotherm fills the bill. And between these extremes there are sixteen intermediate sizes to choose from.

Compact Cyclotherms are also kind to boiler room space — the Cyclotherm is up to 1/3 smaller than the ordinary package boiler. Installation is easy — no costly stack, no excavation, no foundation. The Cyclotherm is shipped complete — ready to operate. Burner and boiler are built together to work together with *one* manufacturing responsibility back of the entire unit.

Cyclotherm's Cyclonic Combustion guarantees a minimum of 80% efficiency. Larger units operate at from 30% to 100% of rated capacity with no loss of efficiency. Smaller units operate on and off automatically according to load requirements. With simpler design and fewer parts, Cyclotherm reduces maintenance costs by from 30% to 50%. Cyclotherm's world-wide service organization gives prompt service on every call. For full information, write us today.

There are 18 Cyclotherm models, ranging from 15 HP to 750 HP. Burns oil and/or gas. The Cyclotherm meets all state requirements and is built in accordance with A.S.M.E. and National Board Standards and bears the label of Underwriters' Laboratories, Inc. Guaranteed against any defect in materials or workmanship. Cyclotherm also manufactures a complete line of Hot Water Generators in 10 capacities, from 670,000 BTU per hr. to 6,700,000 BTU per hr.



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STEAM & HOT WATER
GENERATION
CYCLOTHERM®
STEAM AND HOT WATER GENERATORS
A Division of National-U.S. Radiator Corp.
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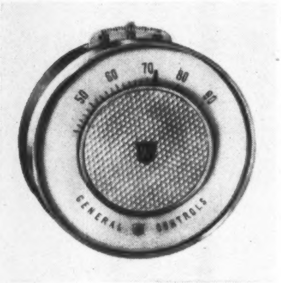
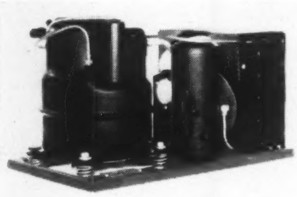
Please send me free 4-page folder on Cyclotherm Steam and Hot Water Generators.



Room Thermostat . . .

. . . in "add-on" design—*General Controls Co., Dept. HPAC,* 801 *Allen Ave., Glendale* 1, *Calif.*

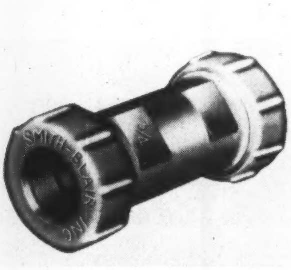
"Versatrol" is basic gas cock safety combination consisting of "A" valve, "B" valve and manual reset thermomagnetic safety. Various thermostatic operators and gas pressure regulators can be added to combination for modification of installation, including conversion from LP gases to natural gas and vice-versa.



Condensing Unit . . .

. . . designed for low temperature applications using refrigerant 12—*Bendix-Westinghouse Automatic Air Brake Co., Dept. HPAC,* 950 *E. Virginia St., Evansville* 11, *Ind.*

"BRL50T" 1/2 hp model condensing unit has twin cylinder motor compressor said to give high starting torque. Available in specified voltages of 115 or 230.



Compression Couplings . . .

. . . designed for joining 1/2 through

new...

THE **Dwyer**

Filter Gage

tells exactly when to change filters . . .

lasts indefinitely . . .

fits all furnace and air conditioning units . . .

SERVICE
FILTER
GAGE
costs only
$1.95

one hole, 60 second installation

Individually packaged with display/merchandising counter sales carton. A foolproof filter gage that really works sold on a satisfaction or money-back guarantee. Write for free sample and discounts.

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ALL SHIPPED IN DISPENSER-TYPE CARTONS

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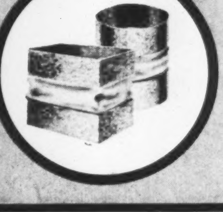
COILS OF PROFIT

Quick, Economical, Easy, and Practical Methods for- - -

FABRICATING FLEXIBLE DUCT CONNECTIONS VANES FOR ELBOWS • AIR SCOOPS AND LOUVERS



PRE-FAB-RIC

A PREFABRICATED FLEXIBLE DUCT CONNECTION

Using a fabric (of your choice) in the center with a galvanized metal strip on each side. *Double-Safe Locked* together in a single continuous piece, coiled in a dispenser-type carton ready for use.

A TYPE, SIZE, AND PRICE FOR ALL JOBS

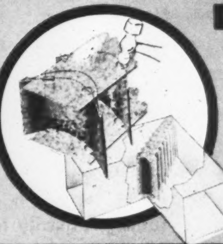
THREE GRADES
Commercial - Economy
Residential

THREE FABRICS
Canvas - Asbestos
Neoprene

FAB-RIC

TOP QUALITY FABRICS (Without Metal)

Same Weight and Width (5") Used in PRE-FAB-RIC. Put Up in 100' Rolls



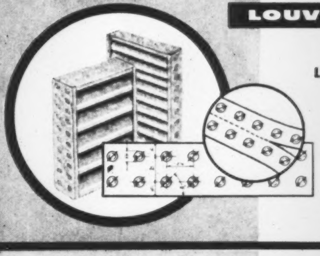
INSTANT-VANE RAIL

ELIMINATES

Layout, Tab Cutting, Hole Punching, Spot Welding, Riveting, Etc., Results in a Savings Up to 70% over old methods.

Best method ever devised for installing turning vanes (single or double) in sq. elbows.

100 FT. COILS **ENGINEER APPROVED**



LOUVERAIL

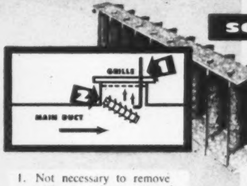
ELIMINATES

Layout, Tab Cutting, Hole Punching, Riveting, Spot Welding, Etc.

AN ECONOMICAL AND PRACTICAL METHOD FOR FABRICATING LOUVERS — REMOVABLE, HINGED, OR STATIONARY. LOUVERAIL is 24 ga. galvanized 4½" wide in (2—50' lengths) 1 right and 1 left coiled together.

Split (½) Rail for Louver Thicknesses From 1¼" to 1¾".
Use Full Size Rail for Louver Thicknesses From 3¼" to 4".

SCOOP-RAIL

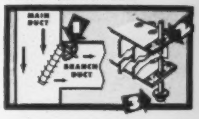


1. Not necessary to remove grille to adjust volume. Use bent rod or wire thru grille to adjust unit in and out of main duct.
2. S. M. screws at top and bottom.

ELIMINATES —
- **Radius ell, transition, and splitter damper at branch duct take-offs.**
- **Volume damper on grille.**
- **Job delay in ordering.**

SCOOP-RAIL for fabricating air scoops for branch ducts and grille collars. Insuring uniform air distribution. Complete control of air volume in branch duct or at grille face. Simplifies balancing of the system.

USED AT BRANCH DUCT



1. ⅝" standard quadrant where accessible.
2. Speed nut tabs for ⅝" square rod are riveted, spotwelded or s. m. screwed to ends of SCOOP-RAIL.
3. Where desired clg control may be used.

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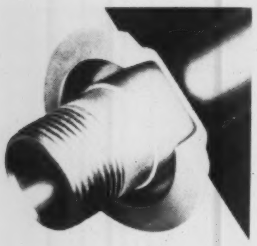
Some Territories Open for Manufacturers Agents Calling on Jobbers and Distributors

CAIN MANUFACTURING CO.

1111 North 5th Avenue **Phone FA 2-0354** **Birmingham, Alabama**

2 in. iron pipe—*Smith-Blair, Inc., Dept. HPAC,* 535 *Railroad Ave., South San Francisco, Calif.*

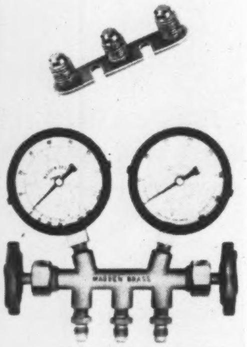
Couplings have cast malleable iron sleeves and end nuts. Available in two models: "Type 511" in short sleeve lengths; "Type 512" in long sleeve lengths. Have blue lacquer or galvanized finish as specified.



Pipe Grommet . . .

. . . fabricated from flexible vinyl material—*L-M-R Engineering Corp., Dept. HPAC, Clayton P. O. Box* 106, *St. Louis* 5.

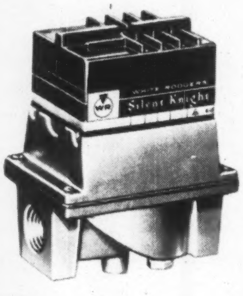
Vinyl grommets developed for low pressure sealing where piping passes through panels up to 14 gage thick. Grommets snap into place, need no adhesive, are self-positioning and self-sealing. Resists most chemicals, acids, says manufacturer; seals off air, moisture, dirt, odors.



Refrigerant Charging Units

. . . designed for charging, testing, purging high and low sides—*Madden Brass Products Co., Dept. HPAC, P. O. Box* 444, *Aurora, Ill.*

Charging, purging, testing unit has all brass forged body, easy-grip handles, replaceable plastic seat. Three $\frac{1}{4}$ in. SAE flare connections enable use of color coded charging lines. Hose holder, hanging hook also available.



Gas Valve . . .

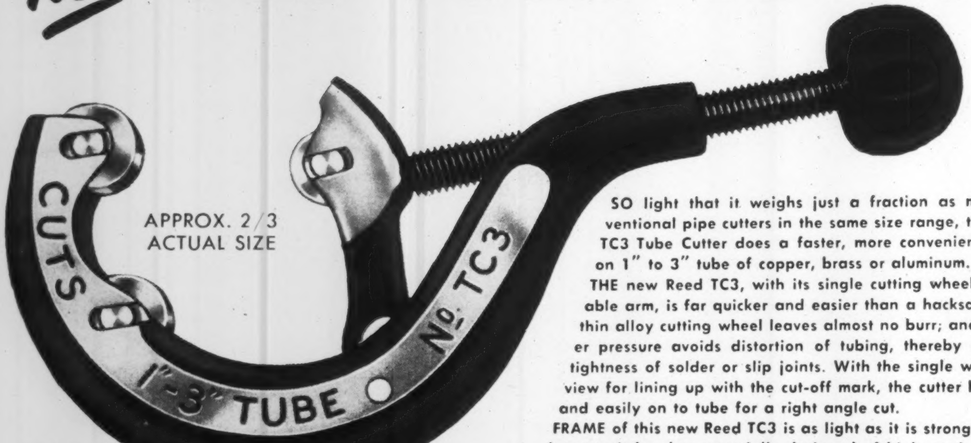
. . . designed for use with all types of small commercial heating—*White-Rodgers Co., Dept. HPAC,* 1209 *Cass Ave., St. Louis* 6.

Entire operating mechanism of valve contained in sealed compartment filled with silicone oil to provide quiet operation. Available with or without non-recycling or automatic recycling manual operator; also

REED

This new Reed Tube Cutter—a faster, lighter-weight roller cutter—is the first cutter for 1" to 3" copper tubing; equally ideal for brass and aluminum tubing from 1" to 3".

New TC3 TUBE CUTTER!



APPROX. 2/3
ACTUAL SIZE

PATENT
PENDING

SO light that it weighs just a fraction as much as conventional pipe cutters in the same size range, this new Reed TC3 Tube Cutter does a faster, more convenient cutting job on 1" to 3" tube of copper, brass or aluminum.

THE new Reed TC3, with its single cutting wheel in the movable arm, is far quicker and easier than a hacksaw; the ultra-thin alloy cutting wheel leaves almost no burr; and TC3's lighter pressure avoids distortion of tubing, thereby safeguarding tightness of solder or slip joints. With the single wheel in plain view for lining up with the cut-off mark, the cutter hooks quickly and easily on to tube for a right angle cut.

FRAME of this new Reed TC3 is as light as it is strong and durable because it has been specially-designed of high-grade ductile iron

REED

REED MANUFACTURING COMPANY ERIE, PA., U.S.A.

TO KEEP MAINTENANCE COSTS DOWN . . .

New $6,000,000 Hospital Selects LUNKENHEIMER VALVES

Thanks to sound planning, valve maintenance expenses in this new Hospital will be kept to a minimum. Lunkenheimer Solder End Valves were installed because, part-for-part, they provide longer maintenance-free performance than any other valves designed for similar service. They have established unmatched performance records on steam, hot and cold water lines, heating and air conditioning systems, as well as oil and gas lines, in commercial, industrial and institutional buildings all over the world. Why put less than the best in specifications, when the best costs no more? For specific recommendations on maintenance-saving Lunkenheimer Valves for new projects or for manufactured equipment . . . write The Lunkenheimer Company, Cincinnati 14, Ohio.

Hospital Administrator: Vernon T. Spry
Chairman of Building Committee:
Clifford G. Retherford
Architects and Engineers:
Ellerbe and Company
General Contractor: Kraus-Anderson, Inc.
Plumbing Superintendent:
Douglas Erickson
for Bolden Porter Company

This impressive $6,000,000 structure will house the new Methodist Hospital, located just west of Minneapolis, in St. Louis Park. It will provide over 276 beds and 60 bassinets for the surrounding community, and a four-floor nurses' residence for over 135 student nurses and other personnel.

LUNKENHEIMER
QUALITY

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

ONLY
RAMSET

offers the fastening versatility you need!

Only with Ramset, can you handle *all* the requirements for heavy-duty fastening to steel, concrete or masonry. "Job-fitted" fasteners and a wide variety of fixtures adapt the basic tool for any job. Simple one-hand operation makes Ramset the easiest-to-use powder-actuated fastening system, what's more, ease of operation makes it the most economical. Ramset assures you of the lowest in-place fastener costs, and a neater job, too . . . without drilling, plugging or chipping. No power lines or bulky equipment!

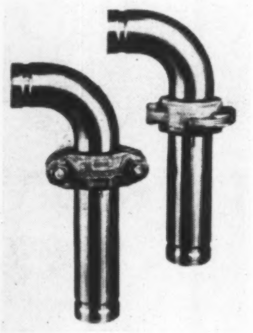
Your Ramset dealer's name is under "Tools" in the Yellow Pages—call him for more information, or write us direct.

In addition to powder-actuated fastening, the versatile Ramset System includes Shure-Set hammer-in tools for light fastening, and Ringblaster heavy-duty kiln gun.

Ramset® Fastening System

WINCHESTER-WESTERN DIVISION • OLIN MATHIESON CHEMICAL CORPORATION
12109-C BEREA ROAD • CLEVELAND, OHIO

available with plug-in pilot. Capacities conform to NEMA standards for sizes 3/8 in.; 1/2 in. "Junior"; 1/2 in. small and large; 3/4 in. small and large; 1 in. pipe.



Pipe Fittings . . .

. . . designed to permit integrated quick-coupled systems in wide range of piping materials—*Victaulic Co. of America, Dept. HPAC, P. O. Box 509, Elizabeth, N. J.*

New line of Schedule 5 and 10 roll grooved stainless steel pipe fittings includes elbows, tees, crosses, returns, stub and blank ends, reducers, reducing tees available in sizes 1¼ to 4 in. diam. Fittings made from Types 304 and 304L austenitic 18-8 chromium-nickel stainless alloy. Also available in 316 and 316L alloy, containing 11 percent nickel addition for systems serving more severe temperatures, corrosive conditions. Coupling method utilizes pressure-sensitive gasket that bridges pipe ends and housing that fits into circumferential grooves in piping.

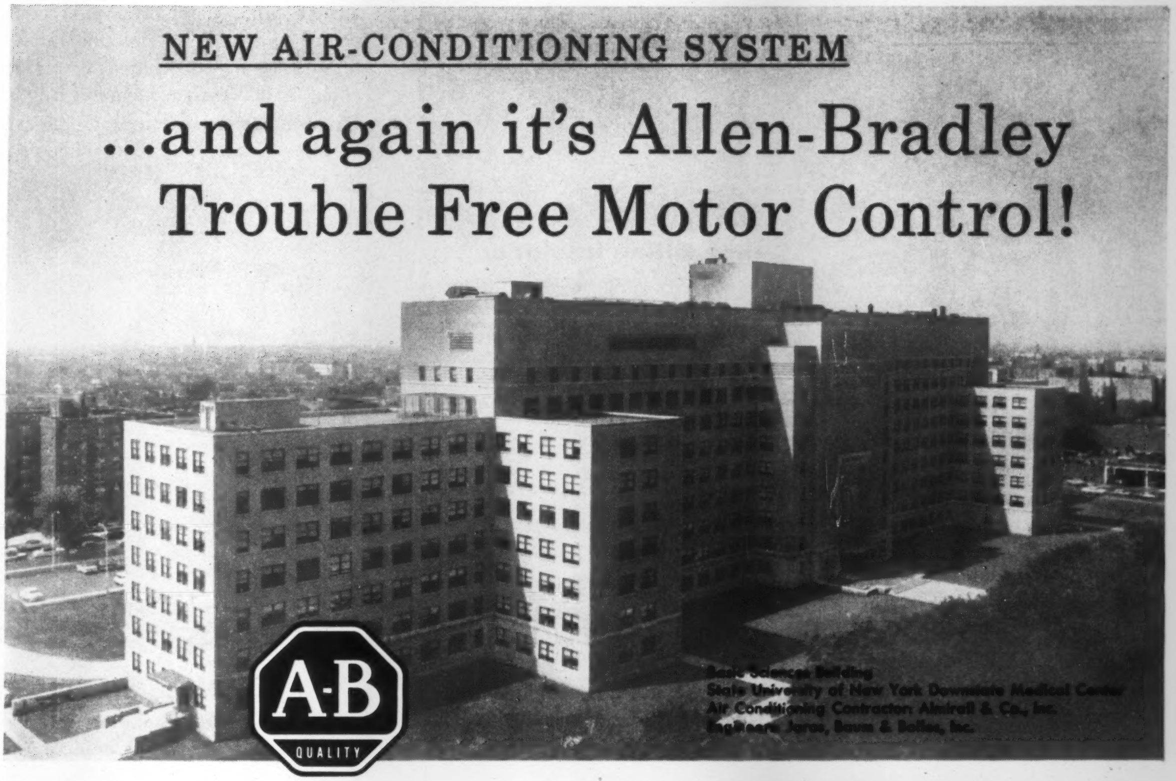
Electric Heat Thermostat . .

. . . designed primarily for electric baseboard, wall heaters, portable heaters—*White-Rodgers Co., Dept. HPAC, 1209 Cass Ave., St. Louis 6.*

"Series 261" single pole, remote bulb, electric heat thermostat has differential of 1½ F. Control has range of 50 to 100 F. Suitable for mounting in ambient temperatures to 150 F. Electrical rating: 22 amp, 5000 kw, 240 volt or 2500 kw, 120 volt a-c. Standard capillary lengths: 6 and 12 in.

NEW AIR-CONDITIONING SYSTEM

...and again it's Allen-Bradley Trouble Free Motor Control!



Basic Sciences Building
State University of New York Downstate Medical Center
Air Conditioning Contractor: Almirall & Co., Inc.
Engineers: Jaros, Baum & Bolles, Inc.

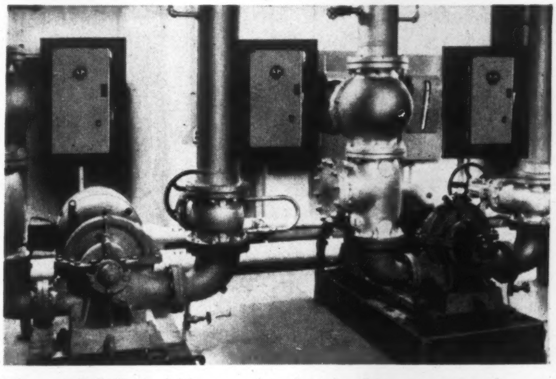
A-B
QUALITY

Consulting engineers—the men who *know* the importance of reliable performance—prefer to see Allen-Bradley motor control on *all* their jobs. Here's why: The simple solenoid design—exclusive with A-B in all starters up through Size 8—has only ONE moving part. This assures *years* of trouble free operation. A-B starters also have maintenance free, double break, silver alloy contacts and permanently accurate overload relays. All these features guarantee "user" satisfaction.

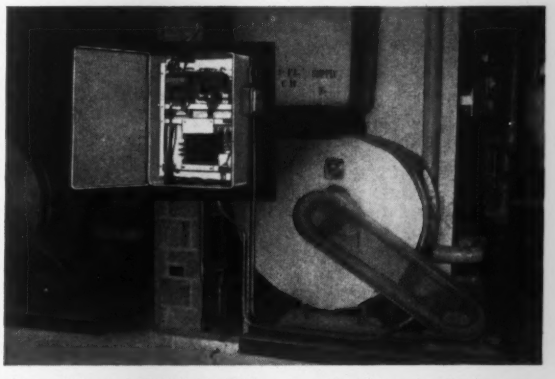
Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

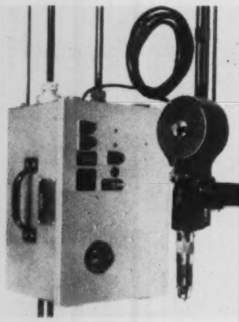
A-B Bulletin 646 manual reduced voltage, autotransformer starter for a 7½ hp fan motor.



Three A-B Bulletin 646 manual reduced voltage autotransformer starters used with the 50 hp condenser water pump motors.



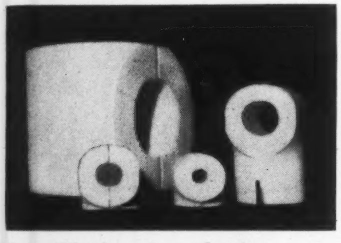
One of three A-B Bulletin 746 automatic reduced voltage autotransformer starters for the supply and exhaust fan motors.



Welding Torch . . .

. . . combines portability with maintenance ease—*Linde Co., Div. of Union Carbide Corp., Dept. HPAC, 30 E. 42nd St., New York 17.*

Designed for applications where maximum portability is required. "Sigmette" torch weighs 3 lb, control box less than 20 lb. Rated up to 200 amp, torches available for full welding range with either 0.30 or 1/16 in. aluminum wire. Screwdriver said to be only tool necessary for maintenance.



Pipe Fitting Insulation . . .

. . . for low temperature piping—*Glo-Brite Products, Dept. HPAC, 6415 N. California Ave., Chicago 45.*

Fitting covers of "Styrofoam" machined to fit wide range of elbows, joints, tees, valves, other fittings in range of sizes for commercial, industrial requirements.

Plastic Pipe . . .

. . . in large diameter sizes—*Allied Chemical, Semet-Solvay Petrochemical Div., Dept. HPAC, Tonawanda, N. Y.*

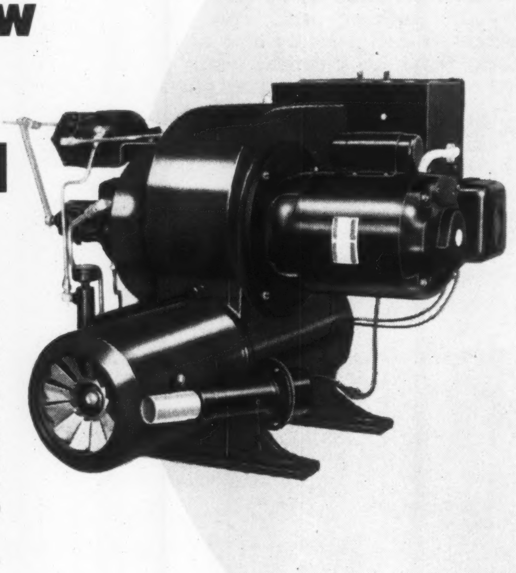
New extrusion technique utilizing standard extrusion machinery makes possible use of polyethylene pipe compound in production of large diameter pipe. Company's pipe compound said to have molecular structure consisting of chains averaging about 70,000 carbon atoms in length. Large diameter polyethylene pipe can be joined by flanging both ends, says manufacturer.

VIRGINIA Chemicals
CAN·O·GAS
"FREON-22"
MONOCHLORODIFLUOROMETHANE
NET WEIGHT 14 OZ

Refrigerant Container . . .

. . . capable of withstanding internal pressure of 480 psi—*Aluminum Co.*

(*Continued on page 234*)



Keep heating costs low with HEV-E-OIL commercial-industrial burners

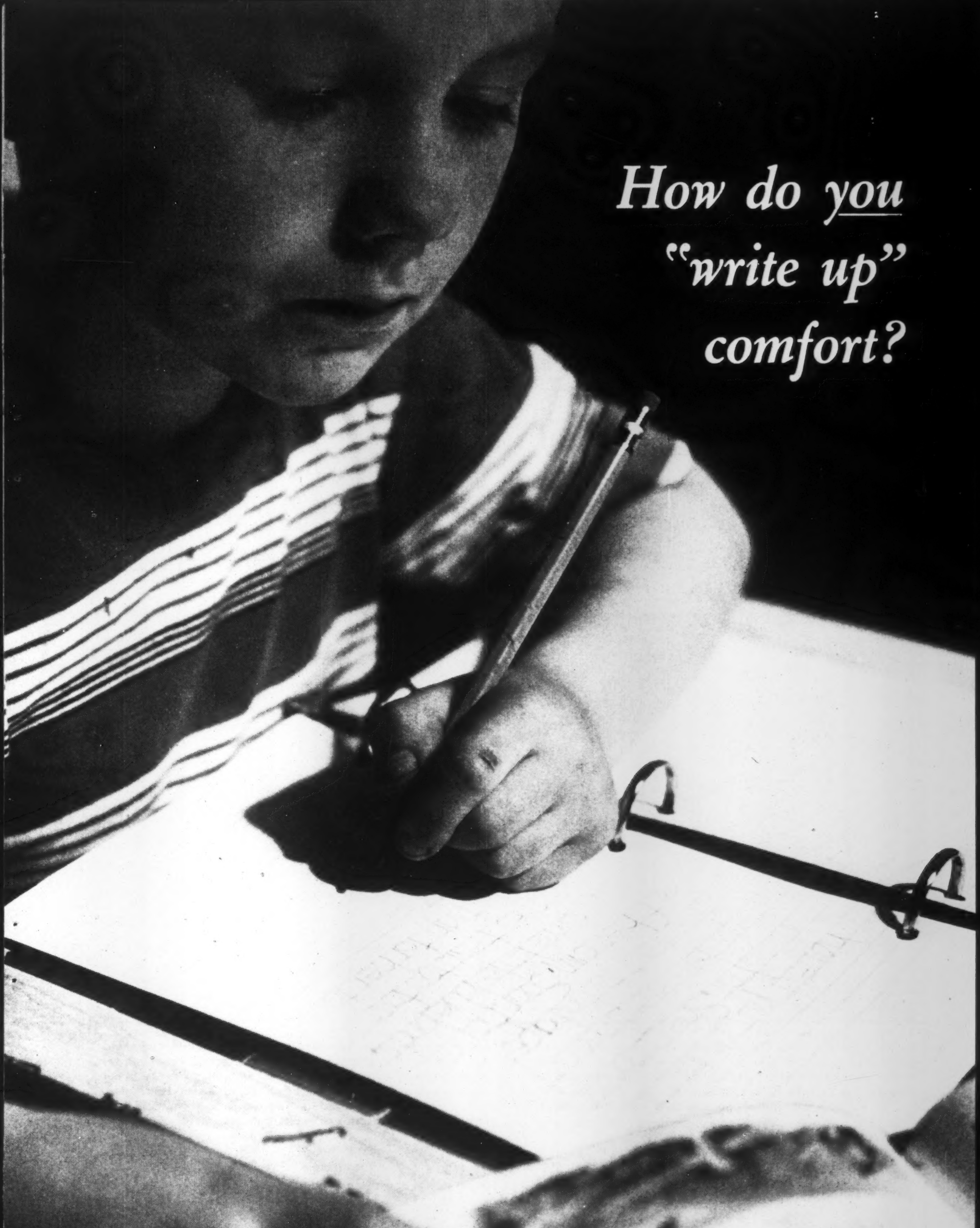
Hev-E-Oil burners furnish all the air necessary for combustion, assuring perfect fire control under all weather conditions. Low fire start that builds up gradually to the flame size required means smooth, safe operation. And once the burner is set for greatest efficiency, it *stays* that way no matter what the weather.

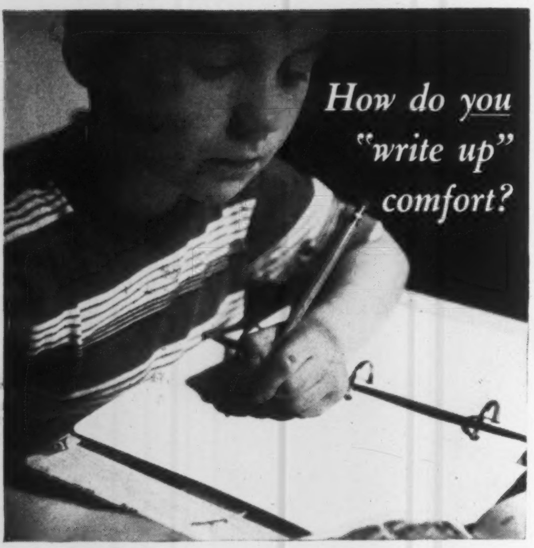
A complete package! Fire tested! Automatic, electronic controls. Meets all codes. Easy to install . . . Hev-E-Oil models from 5 to 150 gph. Also available, Hev-E-Duty power gas burners and combination gas/oil burners from 720,000 to 21,000,000 B.T.U.

For more information write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wis., Dept. HPA-3.

INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4507 N. OAKLAND AVE., MILWAUKEE 11, WISCONSIN


How do you "write up" comfort?


How do *you* "write up" comfort?

When it's comfort via ventilation...

In the past two years 1110 schools and universities throughout the country installed Ilg electric ventilating equipment.

Consulting engineers as well as school boards know today's crowded classrooms and higher standards make proper ventilation more a "must" than ever before . . .

Here's why ILG fans and motors move more air

ILG SELF COOLED MOTOR FAN
CHICAGO U.S.A.

Not a Ripple in the Glass at 1140 revolutions. Ilg direct-connected propeller fans are quiet, vibration-free power savers. Ilg's "One-Name-Plate" pledge of performance covers *both* the dynamically balanced, patented Type "Q" fan wheel . . . the Ilg-built self-cooled, permanently lubricated motor.

Low-Down on Low Silhouette. Ilg power roof ventilators, with lifetime aluminum housings, are low in height, low in operating costs, low in maintenance. Ilg-built self-cooled motor—direct-connected to patented "Q" Type fan wheel—assures quiet, vibration-free operation. Choice of 11 sizes, single-phase permanent-split capacitor or 3-phase motor.

For fans built to satisfy your "specs"...

1110 schools recently "wrote up" comfort this way . . . ILG

that the health as well as the study habits of today's students all too often hinges upon having enough fresh air.

But why the preference for Ilg fans and ventilators? Shown below are some of the reasons why Ilg equipment rates so well with consulting engineers . . . and with school authorities. Ilg fans cost less to operate, move more air more quietly for more years, last longer with less maintenance.

For further details on the complete line of Ilg ventilating equipment, send for Catalog No. 159 on propeller fans, Bulletin No. 257 on *airfoil* centrifugals, Bulletin Nos. 2302 and 2701 on power roof ventilators.

ILG® *power roof ventilators*

more quietly for more years

"X Marks the Spot" where the traveling mike picks up sound waves from this Ilg BC *Airfoil* centrifugal. Backward Curved (BC) blades eliminate eddy currents and turbulence. Sound tests prove these direct-connected fans can provide larger air capacity than older types—with *no increase in sound level,* with *less drag and shock loss.* For operations to 9" static pressure.

Heart of the Matter. Ilg Backward Curved *Airfoil* centrifugal fans—under this low profile housing—assure smooth, quiet air flow and low shock loss. Ilg-built *self-cooled* motors and *patented* pressure-type cooling of separate motor compartment eliminate heat build-up of *any* type. Direct connection does away with belt maintenance, friction loss, slippage.

specify ILG®

ILG ELECTRIC VENTILATING COMPANY
2826 N. Pulaski Road, Chicago 41, Illinois
Offices in 57 Principal Cities
Member of Air Moving and Conditioning Association, Inc. (AMCA)

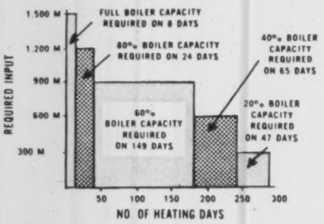
HYDROTHERM

PACKS
A 20%
GAS
SAVING
HERE
Here's where
MultiTemp reduces
gas costs by 20%.
Return header
has independent,
differentially set
aquastats that trigger
each boiler, modulate input,
and eliminate short cycling waste.

New
MULTITEMP SYSTEMS
Make Gas Heat Competitive on "BIG JOBS"

Now even the big jobs requiring up to 3,600,000 BTU/hr input can enjoy the convenience and cleanliness of gas heat. A Hydrotherm MultiTemp system achieves true input modulation, brings gas consumption down and, being composed of multiple units, insures against service interruptions.

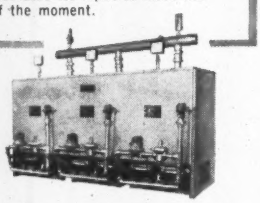
A MultiTemp battery of Hydrotherm boilers is hooked up with a separate aquastat for each boiler in the common return header. With each aquastat set for a different temperature, the boilers are fired or cut off independently. When the demand is small, only one boiler operates... when it is great or when the system is making a cold start, the complete heating plant is fired.



This graph shows the year-round load for a 1,500,000 BTU/hr hydronic plant in Bergen County, N. J., where degree days average 5600 to 6000. Heat was required for 293 days, but full capacity was needed for only 3% of that time.

Note how a single 1,500,000 BTU/hr boiler would have short cycled for 89% of the heating season at a great loss in efficiency. Note also how the MultiTemp battery of five 300,000 BTU/hr boilers modulated its input to meet the heating demand of the moment.

- *Input Ratings from 360,000 to 3,600,000 BTU/hr*
- *100 lbs. ASME Working Pressure*
- *Boilers Shipped Pre-Wired and Assembled*
- *Units Pass Thru 2'6" Doors*
- *Ideal for Volume Hot Water*



Write today for MultiTemp Catalog

HYDROTHERM INC

DEPT. 13-AC NORTHVALE, NEW JERSEY

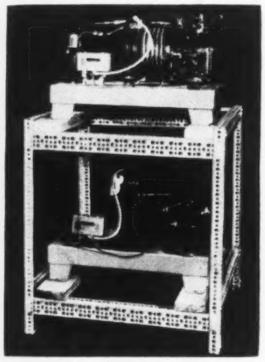
OTHER FAMOUS HYDROTHERM PRODUCTS: HydroTherm • HydroVector • HydroChiller • HydroFin

EQUIPMENT DEVELOPMENTS

Continued from page 230

of America, Dept. HPAC, 1501 *Alcoa Bldg., Pittsburgh* 19.

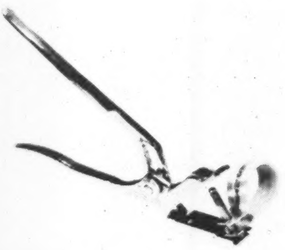
Seamless, small aluminum container designed to package refrigerant gas, is portable and disposable. Each can contains 14 oz of refrigerant No. 22.



Compressor Racks . . .

. . . designed for mounting compressors, condensers, other air conditioning equipment—*Acme Steel Co., 135th St. and Perry Ave., Dept. HPAC, Chicago 27.*

Rack mounting of equipment said to reduce rust, dust collection, give greater accessibility. Rack kits require only bolting for complete assembly, provide slots for attachment of piping and wiring.



Clamp Pliers . . .

. . . designed to secure bolt, while clamp is mechanically closed, locked in place—*TA Mfg. Corp., Dept. HPAC, 4607 Alger St., Los Angeles.*

Using "No. 82" plier, both hands are free for attaching nut or for stacking additional clamps into lock position. Made of forged steel. Available for standard No. 8 or No. 10 size bolts.

STEEL PIPE MAKES ICE SKATING ALMOST A YEAR-AROUND SPORT!

From November through March, and even longer, artificial ice rinks are reviving outdoor skating as a national all-family sport.

A majority of these rinks utilize grids of *steel pipe* to circulate the refrigerant which freezes and maintains good skating ice, independently of outdoor temperatures. From 10 to 20 miles of 1 and 1¼ inch *steel pipe* may be used in a typical installation.

This is economically possible because *steel pipe* is not only the least expensive but also the most versatile of tubular products. That's why it is the most widely used pipe in the world for refrigeration, radiant heating, snow melting, fire sprinkler systems, vent and drainage lines, electrical conduit, structural uses, gas, oil and water lines.

STEEL PIPE IS FIRST CHOICE

- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

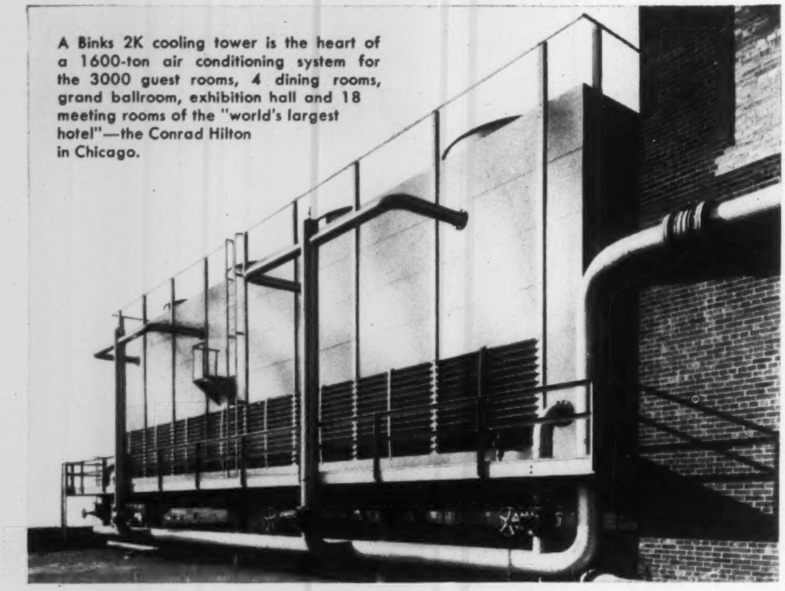
INSIST ON PIPE MADE IN U.S.A.

More than 128,000 feet of 1¼" *steel pipe* were used in this huge skating rink.

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

150 East Forty-Second Street, New York 17, N.Y.



A Binks 2K cooling tower is the heart of a 1600-ton air conditioning system for the 3000 guest rooms, 4 dining rooms, grand ballroom, exhibition hall and 18 meeting rooms of the "world's largest hotel"—the Conrad Hilton in Chicago.

CONRAD HILTON HOTEL, CHICAGO

Saves $75,000 a year on water with Binks 2K cooling tower

"In 1956 we installed a Binks 2K cooling tower. It is more than paying its own way," reports Mr. H. M. Toombs, chief engineer for the Conrad Hilton Hotel, Chicago.

Only 5% daily make-up

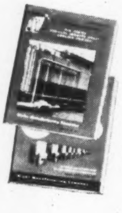
"On a one-pass basis our 1600 ton air conditioning system would use six million gallons of cooling water daily. Instead we recycle 8600 gallons and our actual consumption is about 430 gallons daily through evaporation or drift. The efficiently balanced air-to-water ratios and counter air-water flow lowers entering water from 95° F to 85° F before it is returned to the condenser."

Maintenance savings

"In addition to water savings, the corrosion-resistant features of the Binks 2K tower will provide substantial savings in maintenance, also. The structural framing is hot-dipped galvanized after forming. Casing sheets of 16 gauge steel are also heavily galvanized and the four 120-ft. fans are of aluminum alloy."

Big job or small—call Binks

Binks towers offer you complete selection flexibility for every air conditioning or industrial process cooling need. Bulletins 333 and 477A describe these towers. Ask your Binks Branch Office for a copy. There is no obligation.



9093

Binks
EVERYTHING FOR WATER COOLING

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.

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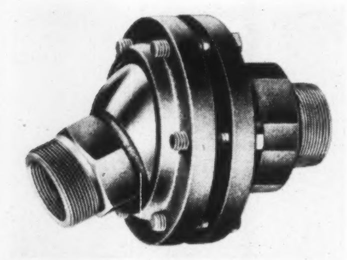
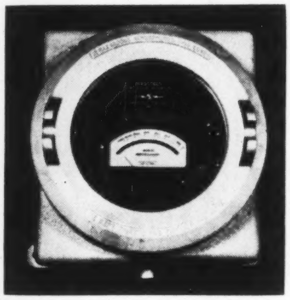


Adjustable Joints . . .

. . . in three new larger sizes—*Spraying Systems Co., Dept. HPAC, 3219 Randolph St., Bellwood, Ill.*

For use in spray nozzle installations where variable angular adjustment of nozzle is desired. New sizes are for large capacity nozzles with 1½, 2, 2½ in. NPT connections. Ball joint design permits positioning at any point over 40 deg included angle and 360 deg rotational range.



Gas Flow Indicator . . .

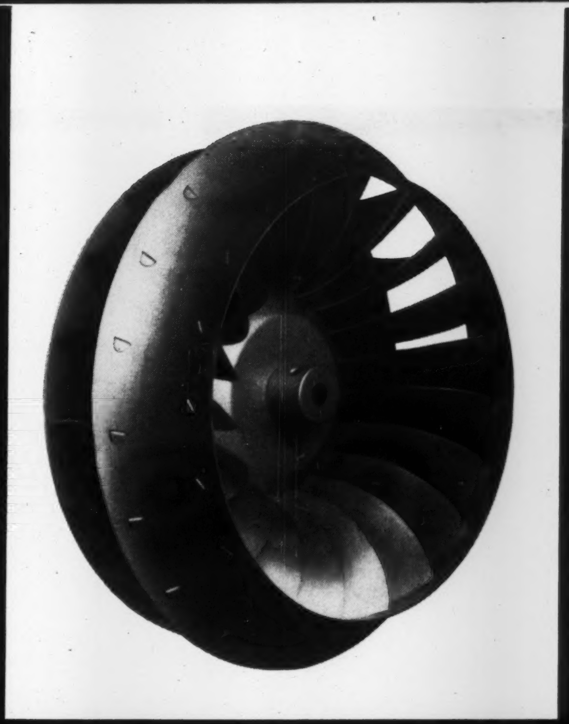
. . . approved for use in presence of flammable and explosive mixtures (Class I, Group D)—*Hastings-Raydist, Inc., Dept. HPAC, Hampton, Va.*

Gas flowmeter consists of "Model FI-6" gas flow indicator and "Type S-16-B" gas flow probe. Indicator furnished with linear scale from zero to 200. Calibration curves available for air over range from 25 to 6000 fpm at STP or from 2 to 150 lb per min per sq ft of cross sectional area.

Electric Motors . . .

. . . developed for applications where quiet vibrationproof is necessary—*Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee 1.*

Drip proof electric motors are of



TORRINGTON CRACKS THE NOISE PROBLEM The squeeze toward compactness in room air conditioners has forced the decibel level up to the point that *noise is now the No. 1 problem.* ❚ In anticipation of this trend, two years ago Torrington's air impeller laboratories went to work on "noise." ❚ The result is the revolutionary Torrington H Wheel—one of the most important breakthroughs in air conditioning history. ❚ In one room air conditioner application test the H Wheel reduced the noise level from 63 to 53 decibels; and it was less than *one half as loud.* ❚ Torrington's engineering department is now offering samples of the H-Series Wheel for evaluation in your new product development program.

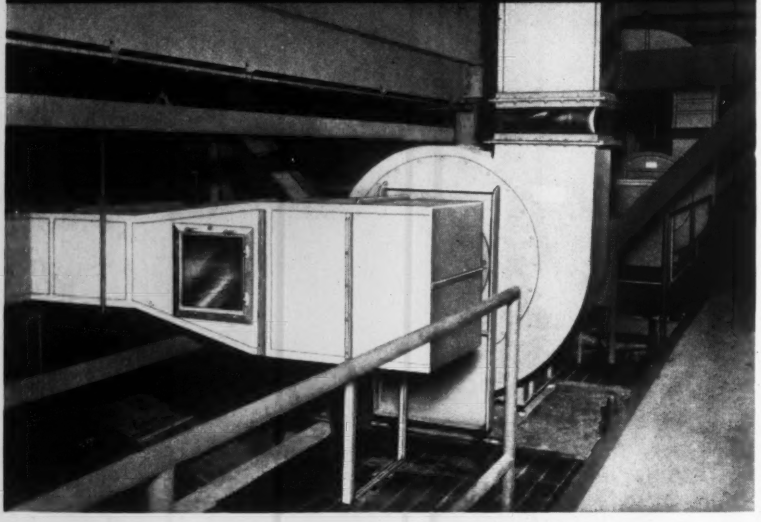
THE TORRINGTON MANUFACTURING COMPANY

TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO

$\frac{1}{2}$

problem: **Corrosive Acid Fumes**

solution: **Van-Cor Exhaust Duct System**

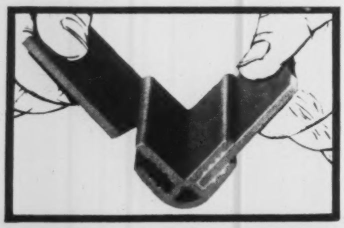


OVER 50,000 SQ. FT. OF VAN-COR SHEET AND JOINING STRIPS remove all acid, plating and cleaning fumes throughout the Allentown (Pa.) Works of Western Electric Co. Corrosion is stopped in its tracks because Van-Cor unplasticized PVC is resistant to scores of acids, alkalies and salts.

Although the contractor was unfamiliar with plastics fabrication, he was able to assemble the components of this system on the job site at a substantial savings over installation of prefabricated components. This savings was made possible through the use of Van-Cor joining strips.

VAN-COR FABRICATIONS, PIPE, FITTINGS, VALVES, CONDUITS offer *you* these advantages:

1. *Resist Corrosion of Industrial Acids & Alkalies*
2. *Light in Weight (½ that of Aluminum)*
3. *Easily Installed; High Tensile Strength; Low Flow Resistance*
4. *Readily Formed, Machined, Threaded and Welded*

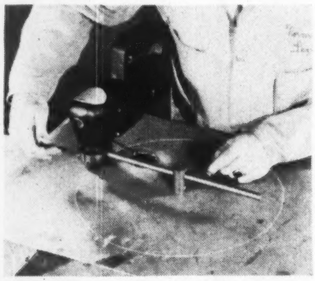


Van-Cor 90° and H Joining Strips
The fast, low-cost way
to connect PVC sheet stock.

Write for Catalog and Name of Nearest Distributor

INDUSTRIAL DIVISION OF . . .
COLONIAL PLASTICS MFG. CO.
Subsidiary of THE VAN DORN IRON WORKS CO.
2685 EAST 79TH STREET CLEVELAND 4, OHIO

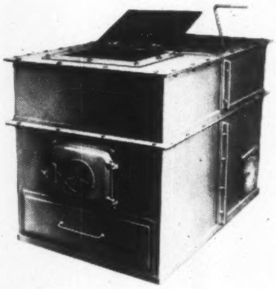
sleeve bearing design (Type G) in NEMA frame series 180 and 210. Standard motor ratings available from ½ to 7½ hp.



Nibbler Attachment . . .

. . . developed for cutting circles from limit of nibbler's radius to unlimited diameters—*Pensco Products, Dept. HPAC, 527 Lexington Ave., New York 17.*

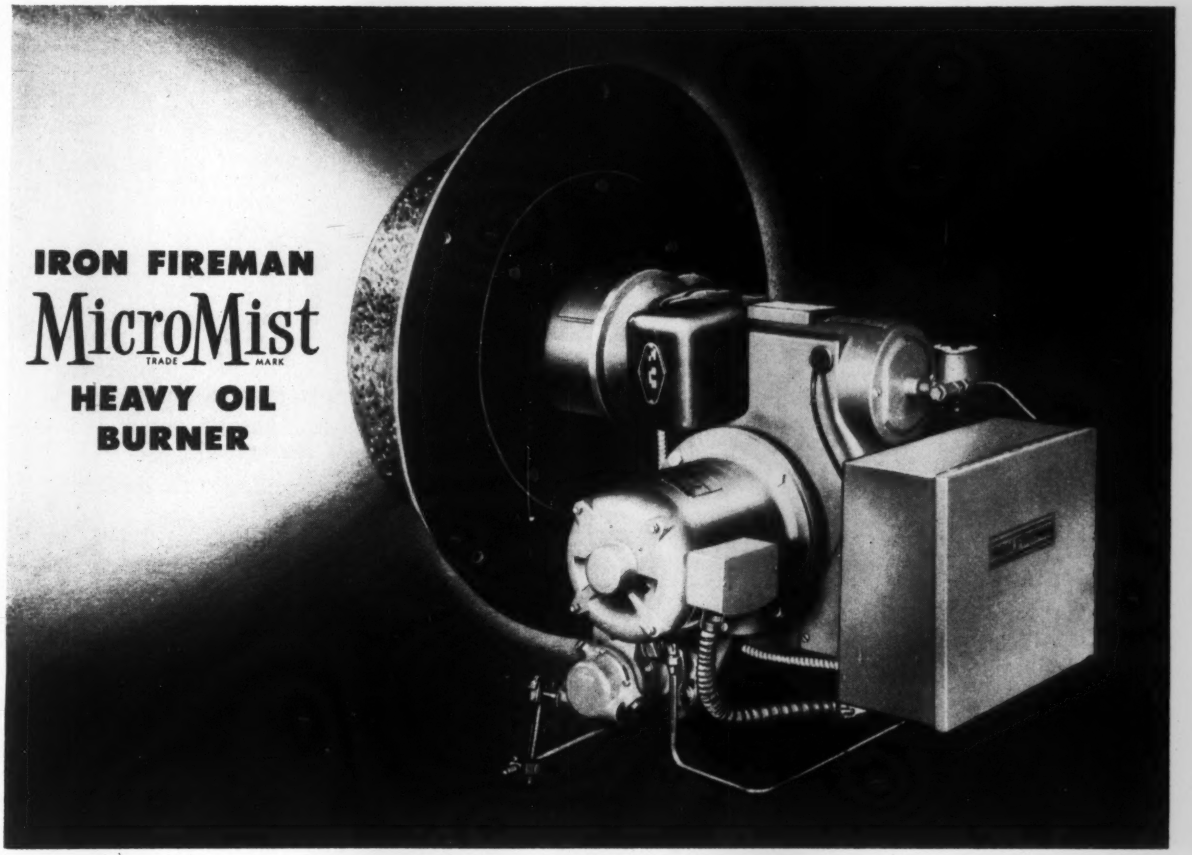
Standard length attachments are 12 or 24 in., but extensions may be added for increased radius. Cutting limit of the 13 lb "HN" nibbler is 10 gage. Model "MN" nibblers for lighter metals have capacity of 14 gage in stainless steel with short radius.



Incinerators . . .

. . . developed to solve waste disposal of both dry and wet trash and wastes—*Brule Incinerator Corp., Dept. HPAC, 13920 S. Western Ave., Blue Island, Ill.*

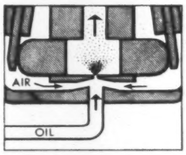
"Consumar" series available in gas, oil, or self-fueled models. New models in line include: "M-7½ Barrelful Consumar" with 6 bu and 60-75 lb per hr; "M-9 Drumful Consumar" with 7½ bu and 70-85 lb per hr; "M-5 Utility Consumar" with 10 bu and 60-80 lb per hr.



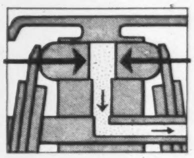
IRON FIREMAN MicroMist HEAVY OIL BURNER

TRADE MARK

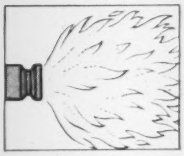
New way to fire low cost residual oil



FIRST
The MicroMist burner makes an airborne oil spray. (This is as far as other burners go.)



SECOND
The airborne spray is compressed. Heat of compression further divides oil particles.



THIRD
Quick decompression of air-oil vapor makes an oil fog that burns with a clear, soft flame.

Residual fuel oils average 10 per cent higher in heat value, yet cost less than light heating oils

Small and medium size heating plants can now fire economy fuels with power plant efficiency.

The Iron Fireman MicroMist oil burner requires little more supervision than an ordinary domestic burner. Every essential component is built in—even the refractory firing throat. No secondary air supply, no refractory checker floor, no gas pilot. (Oil fog is readily ignited by an electric spark.)

The use of low cost fuel is not the only economy feature. Efficiency ratings are very high. Modulating flame accurately accommodates itself to variable loads, eliminating excessive on-off cycling. In modern sealed boilers no high stack is necessary. Maintenance costs are negligible. (Nozzle does not require cleaning.) *Any* grade of oil, from light heating oil through No. 5 fuel oil can be fired without burner adjustment.

The MicroMist burner can be applied to your present boiler, or ordered as a complete boiler-burner unit with compact Scotch boiler ready for service connections. Capacities to 25 gph.

Send for more information

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT
FOR HEATING, POWER, PROCESSING

IRON FIREMAN MANUFACTURING CO.
3161 W. 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ontario)

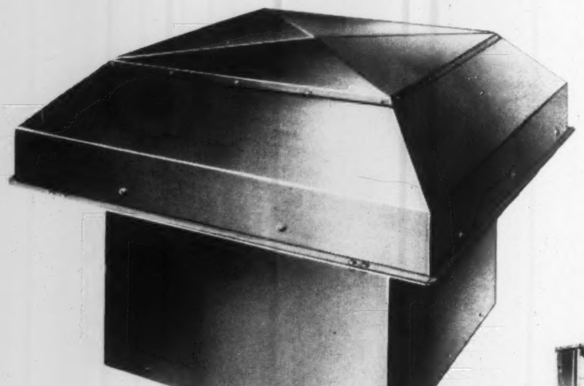
Please send me more information and specifications on the Iron Fireman MicroMist burner.

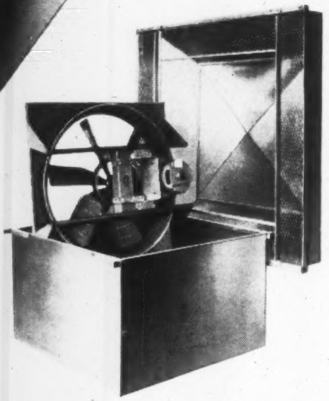
Name
Firm
Address
City Zone State

ENGINEER: I need the assurance of top quality and reliable performance.

CONTRACTOR: I must have prompt shipment, easy installation, and competitive cost.

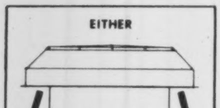
OWNER: I expect quiet, trouble-free service and a ventilation system that really does the job.





COOLAIR
Power Roof Ventilators

FILL ALL REQUIREMENTS



Engineer, Contractor and Owner find in the new Coolair Power Roof Ventilators, Type L, all their requirements for equipment of this kind. For over 30 years, Coolair has been supplying dependable air handling equipment. Write for Form 468 which describes the Type L—or contact our sales office in your city.

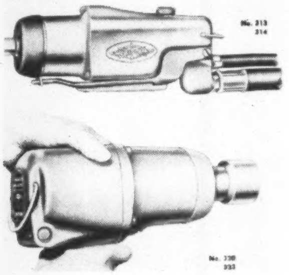
SEE OUR CATALOG IN SWEET'S
INDUSTRIAL CONSTRUCTION FILE

American Coolair Corporation
P. O. Box 2300, Jacksonville 3, Florida

Leading Manufacturers Since 1928
Charter Members Power Fan Manufacturers Assn. and
Air Moving and Conditioning Assn. Inc.

EQUIPMENT DEVELOPMENTS

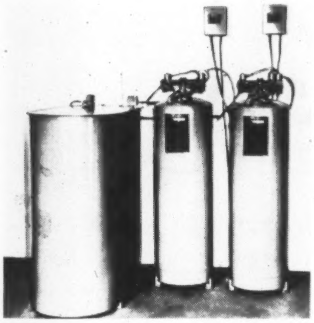
Continued



Impact Wrenches . . .

. . . as additions to two of company's lines—*Albertson & Co., Inc., Dept. HPAC, 3100 Lowell St., Sioux City 2, Iowa.*

Company has expanded its "Sioux" line of air impact wrenches and air screwdrivers with addition of seven new models. Five new models have also been added to its line of electric impact wrenches and electric screwdrivers. Smallest of air impact wrenches are "No. 313" and "No. 314," weighing 2¾ lb and delivering 95 ft-lb of torque. Largest models in line are "No. 320" and "No. 322" which will deliver 1200 ft-lb of torque with 120 lb of air pressure at the tool.

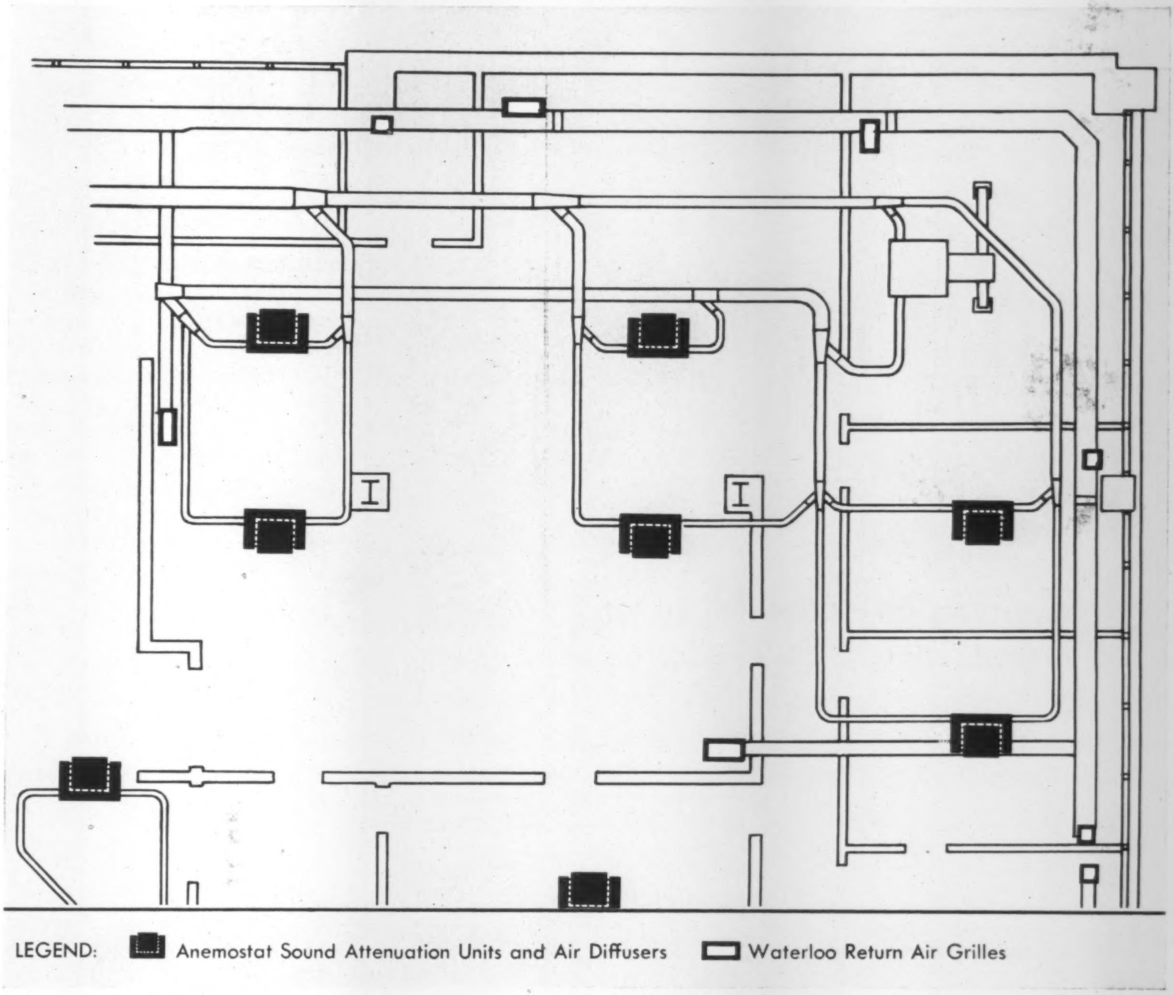


Water Softeners . . .

. . . in single, double units—*F. E. Myers & Bro. Co., Dept. HPAC, Ashland, Ohio.*

Softeners capable of automatic softening of water at service flow rates to 52 gpm. Designed for installation in small hotels, institutions, small hospitals, schools, other similar applications. Four basic units available with capacities ranging from 69,000 to 130,000 grains of hardness between regenerations.

When you design or specify be sure of top quality with... ANEMOSTAT® WATERLOO



I
I
LEGEND: ▣ Anemostat Sound Attenuation Units and Air Diffusers ▭ Waterloo Return Air Grilles

In this typical layout you can see how Anemostat All-Air High Velocity units and Waterloo Return Air Grilles team up to insure quiet, draftless, perfectly balanced air distribution.

The Anemostat All-Air High Velocity distribution system offers many important advantages. It can be used with smaller than conventional ducts; it can be installed in less time and at less cost. It requires no coils; therefore, there is no leakage, clogging or odor. Anemostat round, square and straightline diffusers with high velocity units are adaptable to a wide variety of architectural designs.

Waterloo's complete line of registers and grilles is the result of 57 years of experience.

Be certain of top quality performance. Put Anemostat-Waterloo equipment to work in your next job.

ANEMOSTAT®

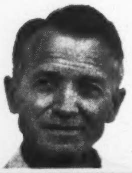
DRAFTLESS *Aspirating* **AIR DIFFUSERS**
ANEMOSTAT CORPORATION OF AMERICA
10 East 39th Street, New York 16, N. Y.
Representatives in Principal Cities

WATERLOO

REGISTER COMPANY, INC.
WATERLOO, IOWA
REGISTERS • GRILLES • VOLUME
CONTROL DAMPERS • DOOR VENTILATORS

"ENTERPRISE Burners perform to our fullest expectations —year after year"

Says Otto Walters, Head Custodian,
Capuchino High School, San Bruno, Calif.



Users, Engineers, Contractors—all agree:

"Everyone Benefits When It's an Enterprise"

The man who's on the job with heating operations day after day has the facts. At the modern, two-level Capuchino High School facility – which includes fifty-one class rooms, heated pool, gym, theater, auditorium, cafeteria, shops and kitchen – this man is Head Custodian Otto Walters. His four Enterprise Burners have delivered smooth, trouble-free service for both class rooms and hot water needs 5 days a week for nearly eight years.

On-the-job performance such as this naturally scores big with everyone down the line – dealer, engineer, contractor and user. Check the facts – you'll learn that the men who specify and work with Enterprise have found the best burner buy!

Fit your specifications to the *right* burner model from the complete range of Enterprise Burner sizes shown here:

HORIZONTAL ROTARY OIL BURNERS, & COMBINATION OIL & GAS BURNERS

INPUT				OUTPUT		
Burner Size	Motor HP	Oil-GPH Max	Gas CF/HR	Steam LBS/HR	Steam BHP	Radiation-Sq. Ft. Steam
AA	½	4	600	464	13	1880
A	½	7	1050	812	23	3280
C	½	15	2250	1740	50	7050
E	½	20	3000	2320	67	9400
F	¾	30	4500	3480	100	14100
G	1	35	5250	4060	118	16400
H	1	50	7500	5800	168	23400
H	1½	60	9000	6960	201	28200
J	2	75	11250	8700	250	35250
K	3	100	15000	11600	336	46900
L	3	135	20250	15660	453	63400
M	5	200	30000	23200	672	94000

The Choice of Heating Experts

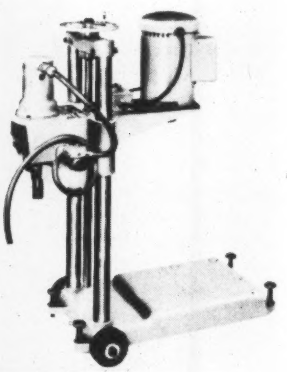
ENTERPRISE

DEPENDABLE BURNERS

ENTERPRISE ENGINE & MACHINERY CO. • 18TH AND FLORIDA STS., SAN FRANCISCO, CALIFORNIA

EQUIPMENT DEVELOPMENTS

Continued



Portable Drills . . .

. . . designed to provide high speed drilling through hardest masonry materials—*Kor-It Co., Inc., Dept. HPAC, 314 Cottman St., Jenkintown, Pa.*

Combining portability with speed, machines said to permit drilling speeds to 1 in. per min in reinforced concrete, granite, fused quartz, tile, asphalt paving, etc. Available in five models for gasoline, electric or air operation, all with interchangeable motors.

LANCASTER DRAIN-PAK

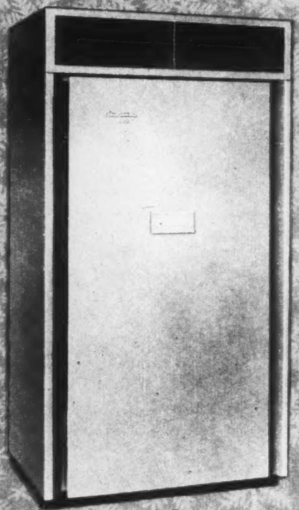
Sump Pump . . .

. . . with all bronze alloy motor housing—*Lancaster Pump & Mfg. Co., Inc., Dept. HPAC, Manheim Pike, Lancaster, Pa.*

"Drain Pak" sump pump available in two models: cast iron, cadmium plated; or all bronze. Both equipped with bronze alloy, 1/3 hp, 115 volt motor. Also available in 230 volt with three-wire cord set for ground connection. Capacity of unit is 3100 gpm against 5 ft head; maximum head said to be 20 ft.

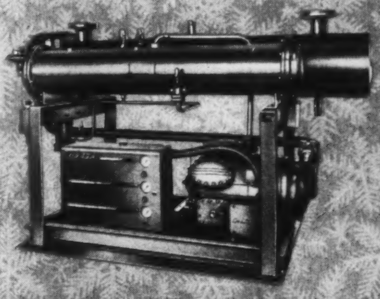
Curtis

CONDITIONS COMMERCIAL AMERICA...

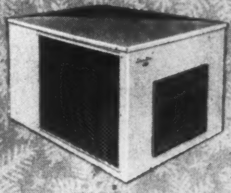


Curtis packaged units minimize floor area required. Factory assembled and tested. Field installation requires only setting and connecting utilities.

PACKAGED AIR CONDITIONERS UP TO 100 TONS.



AIR-COOLED UNITS UP TO 10 TONS.



PACKAGED LIQUID CHILLERS UP TO 100 TONS.

PRECISION

close tolerance manufacturing, builds peak performance into every CURTIS unit.

Curtis is the "luxury line" in the air-conditioning industry. Silence, efficiency and long-life are inherent in Curtis design.

Yet Curtis prices are right in line.

This is why Curtis designs and builds thousands of unique air conditioning systems for commercial America . . . why Curtis is able to maintain a family of over 300 representatives and servicing contractors across the nation.

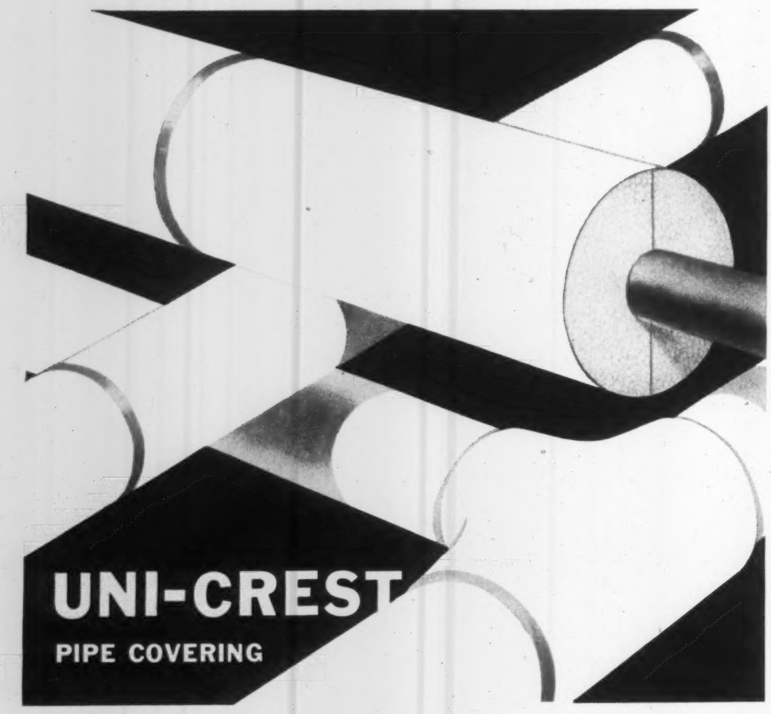
Put the advantages of CURTIS PRECISION into your next job.

Curtis
MANUFACTURING COMPANY
REFRIGERATION DIVISION

OUR 105th YEAR

WRITE DEPT. 5, ST. LOUIS 20, MISSOURI

THE CURTIS "LUXURY LINE" OF AIR CONDITIONERS COSTS NO MORE



a new, economical, low temperature insulation

Uni-Crest, pipe covering, is an excellent low temperature insulating material, and is inexpensive to install and maintain.

Uni-Crest's low thermal conductivity (K factor), plus its high resistance to water and water vapor—are some of its prime qualities. It will not rot, mildew, or support fungus growth.

Extremely lightweight, with a smooth, tough white surface, Uni-Crest is non-dusting, non-flaking, and easily cut and handled on the job. And Uni-Crest is inexpensive, too.

For the address of the office nearest you, plus additional information about Uni-Crest pipe covering and an actual sample, please write to the address below.

UNI-CREST DIVISION UNITED CORK COMPANIES
Since 1907

UNITED'S UNI-CREST EXPANDED POLYSTYRENE

1 Central Avenue, Kearny, New Jersey

BRANCH OFFICES OR APPROVED DISTRIBUTORS IN ALL KEY CITIES

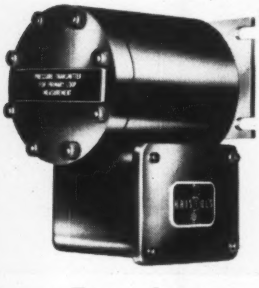
EQUIPMENT DEVELOPMENTS

Continued

Power Saw . . .

. . .including carrying case, blade assortment, lubricant and blade wrench—*R. C. S. Tool Corp., Dept. HPAC, Box 661, Bloomington, Ill.*

"Model 250 Super Saw" integral unit powered by ½ hp, 2500 stroke per min motor operating on 5 amp. Features cited by manufacturer: lightweight design; no exposed moving parts; high grade ball bearings.



Pressure Transducers . . .

. . .developed for nuclear applications —*Bristol Co., Dept. HPAC, P. O. Box 1790, Waterbury, Conn.*

Intended for primary and secondary loop measurements in pressurized water reactors, boiling water reactors, and some organic moderated and homogenous reactors. Construction is entirely of inorganic components for suitability to heavily radioactive environments. Pressure elements are Type 316 stainless steel in ranges from zero to 1 in. water gage to zero to 10,000 psi.

Plastic Tank . . .

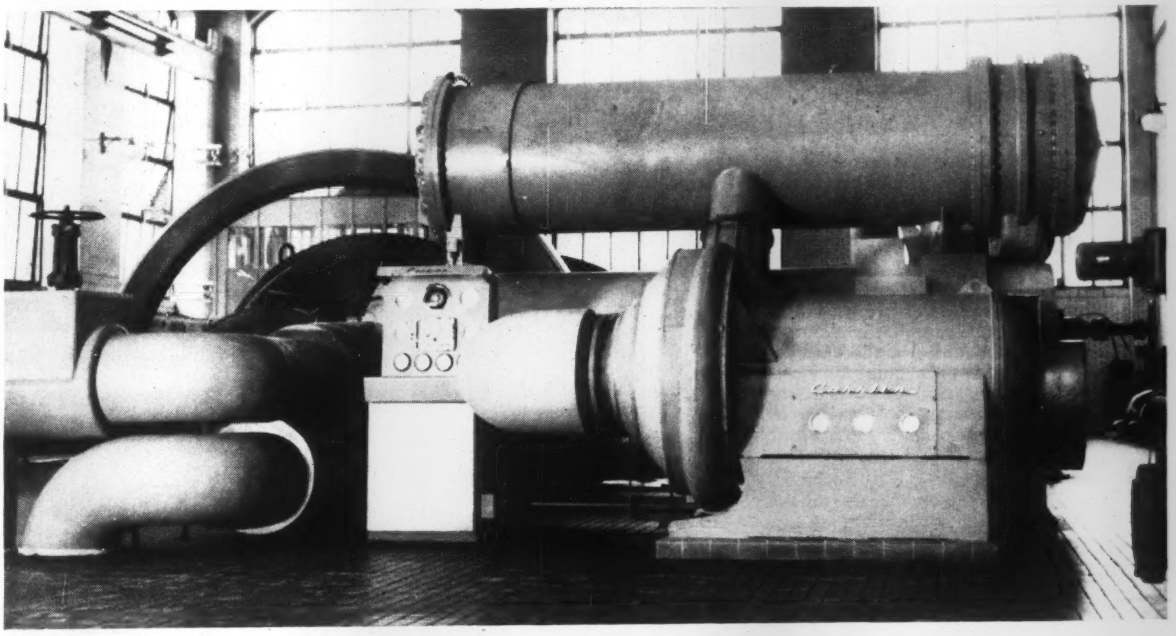
. . . produced with centrifugal molding process—*Apex Reinforced Plastics, Dept. HPAC, Washington and Elm Sts., Cleveland 13.*

Use of centrifugal molding process said to assure uniform wall thickness, finish, eliminate longitudinal seams leading to possible leak or rupture. Material used is glass fiber impregnated with thermosetting resin. Non-conducting material said to eliminate electrolysis between piping and tank. Cycle life of tank beyond 250,000; pressures up to 700 psi.

Carrier Hermetic Centrifugal Refrigerating Machines

now in a complete range of sizes

90 to 1500 tons



Carrier Hermetic Centrifugal Machines are available in a wide range of capacities in each size, with a choice of motor horsepowers and voltages, to meet the most exacting refrigeration load requirements in air conditioning and process cooling applications. In addition to economical selection with performance matched to specific job conditions, the Carrier Hermetic Centrifugal offers important advantages:

It combines weight savings, space savings and efficiency better than ever before achieved in a large refrigerating machine.

It runs smoothly and quietly: can be located on the roof of a building or in the basement without a heavy or costly foundation.

It operates economically. Capacity and power input are adjusted to the load, continuously, by inlet capacity vanes that are positioned, as required, by the hydraulic pressure of the lubricating oil.

It is automatic. After simple push-button starting, electronic controls provide continuous, automatic chilling of water to the desired temperature.

It has mechanical simplicity. The motor-compressor unit, hermetically sealed against air, moisture and refrigerant loss, is factory assembled on a single shaft.

Whatever your refrigeration requirements, there is a Carrier specialist in your area to assist you with the selection.

For detailed information about the Carrier Hermetic Centrifugal Machines, just call the Carrier district or branch office nearest you, or write to us at Carrier Corporation, Syracuse, New York.

Carrier **air conditioning · refrigeration · industrial heating**

7 WAYS YOU GET A BETTER BUY...

with USG Industrial Thermometers

1. You get top quality.
Gotham Industrial Thermometers are made by United States Gauge. That means you get the benefits of 54 years experience in the manufacture of precision measuring instruments.

2. You get high accuracy.
Bores of the mercury columns in Gotham thermometers are held to uniform dimensions for the length of the glass stem. Each thermometer is calibrated under strictest control standards with permanent reference points etched on the lens.

3. You get good readability.
Extra sharp readability is assured by USG's magnifying glass tube with a wide angle reading design, and by use of highly-visible "Red-reading Mercury." Figures and graduations are large, clear and in black on silver background.

4. You get better response.
USG design assures better response to temperature changes in all your applications. Safe, efficient heat transfer material fills the space between metal stem and inserted glass bulb. Where separable sockets are used, metal stem and socket are tapered to assure snug, metal-to-metal contact. Result: you get fast readings, exact readings.

5. You get longer life.
USG Gotham thermometers are ruggedly constructed to "take it." Glass tubes are annealed to remove residual stresses. Extra-heavy glass fronts on the solid brass case are cushioned with chemical-resistant rubber. Maintenance and replacement costs are lowered.

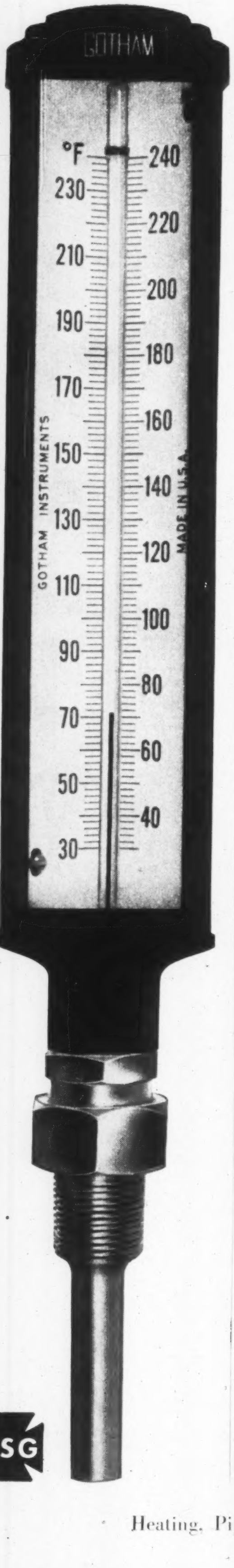
6. You can get any angle mounting.
Rigid mounting types include: Straight, Back Angle, Incline, Recline, Right and Left Side. There is also the USG "Multi-Angle" type which saves valuable manhours on piping layouts because it can be tilted or rotated to any practical mounting angle.

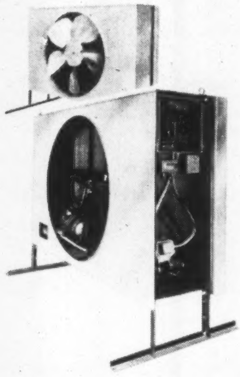
7. You save with the low cost.
There is a USG industrial thermometer for virtually every temperature measurement in heating and air conditioning. Temperature ranges are from —40° to 950° F. Sizes: 7, 9 and 12 inches.

Most important, the USG low price is an eye-opener when you compare thermometer design, features and performance . . . *critically*. Start your big USG savings now. See your USG distributor, or write for Catalog 101.

Find Your Nearest Distributor in The 'Yellow Pages'

UNITED STATES GAUGE USG
Division of American Machine & Metals, Inc., Sellersville, Pa.





Air Cooled Condensers . . .

. . . for air conditioning applications requiring use of water savers—*Dunham-Bush, Inc., Dept. HPAC, 179 South St., West Hartford 10, Conn.*

"LRCU" large remote air condensers available in five basic sizes from 10 through 30 tons. Unit consists of air cooled condenser with motor-compressor, liquid receiver, electrical controls, and refrigeration accessories inter-connected and installed in single package.

Diamond Drill . . .

. . . for drilling close tolerance holes through reinforced concrete, masonry, tile, brick, and rock—*Geo-Drill Co., Dept. HPAC, P. O. Box 6, Bridgeville, Pa.*

Unit can drill vertical, horizontal or angle holes for maintenance applications and for the installation of air conditioning and ventilating systems, pipe, electrical conduit, and ducts. Driven by 1½ hp. 110-220 volt, 60 cycle, a-c electric motor, developing a bit speed of 1000 rpm. Total weight of unit is 190 lb.

Manufacturers Agents

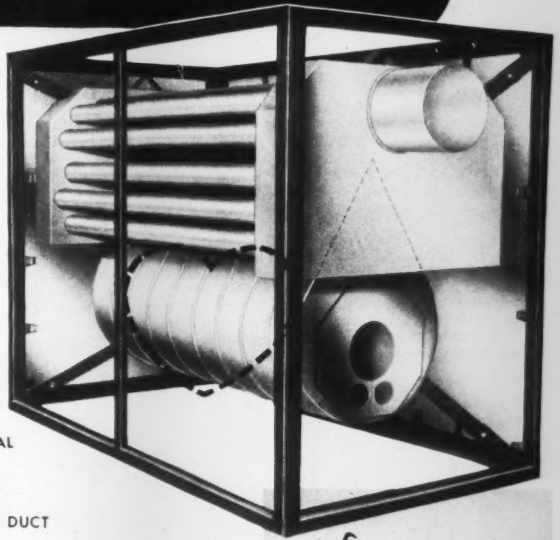
Are you interested in securing additional lines?

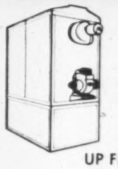
We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial and commercial heating, piping and air conditioning products.

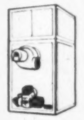
If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

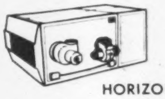
Heating, Piping & Air Conditioning
6 North Michigan Avenue
Chicago 2, Illinois

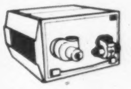
a STRONGER heart of stainless in MAXI-THERM




UP FLOW


COUNTER FLOW


HORIZONTAL


DUCT

One important example of MAXI-THERM'S dedication to quality is their pioneering leadership in applying the new, costlier No. 442 stainless steel to combustion chamber construction.

In addition to being superior, this stainless is used in a heavier gauge, as well, to assure the durable chamber required for MAXI-THERM'S high BTU output for industrial and commercial applications. The chamber is also tear-dropped and ribbed for long life and efficiency. Conveniently tabulated at right are some other hidden pluses found in all four models in the MAXI-THERM line.

Available in standard capacities from 120,000 to 2,500,000 BTU's. Refractory lined series to 2,000,000 BTU's. Larger specials cooperatively engineered.

Write for specification details or representation information

features

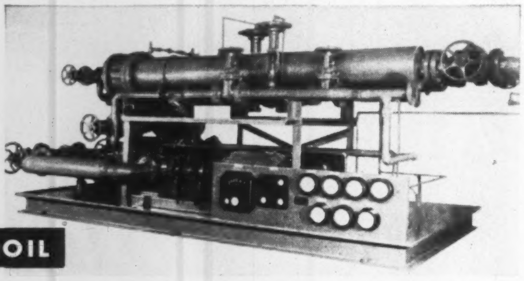
- No. 442 stainless two-pass combustion chamber.
- Two-pass aluminized steel exchanger provides a four-pass system.
- Quint-Angle one-piece welded 12-gauge frame construction.
- Polished radiant shield.
- Tube and transfer box access plate.
- Field flexibility from interchangeability of Up Flow, Counter Flow and Horizontal Models.
- Oil and/or gas fired, single or dual fuel.
- Firing equipment, all fuels, U.L. and A.G.A. inspected and approved.
- Available with duct flange connections or four-way adjustable diffuser heads and screened intakes.

CSF **Chicago Steel Furnace Co.**
9324 S. Anthony Ave. • Chicago 17, Illinois

Fuel Oil Pumping & Heating Units

FOR EVERY REQUIREMENT

NATIONAL AIROIL

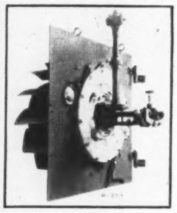


We make a full line of Fuel Oil Pumping and Heating Units to prepare heavy fuel oil for combustion with all types of Oil Burners. Illustrated is a compact, space saving Unit of 50 g.p.m. burning rate — twin motor driven pumps and twin oil heaters built to A.S.M.E. Code. Control panel includes: Pilot Control Thermometer, Pressure Pilot Control, Gauges to indicate oil inlet to each heater, Temperature and Pressure Suction Vacuum, Oil outlet pressure from each Heater and main Steam Pressure to each Unit . . . Temperature and Pressure Control Valves are air actuated for quick response, and to hold discharge pressure and temperature within 1%, from minimum to maximum firing rate.

Send for Catalog No. 40 which gives standard sizes and capacities; special units built to order.

UNIVERSAL REGISTER UNITS

We make various types of Universal Register Units including the swing-type, as illustrated. The Unit illustrated can be furnished with Gas Burners, ring or cylinder type, and/or Oil Burners, for either natural or forced draft . . . All vanes are variable independently of each other, and reversible from left to right turbulence (or vise versa) as a Unit. Integral damper disc permits closing-off each individual burner tile to prevent air leakage on shut-down.



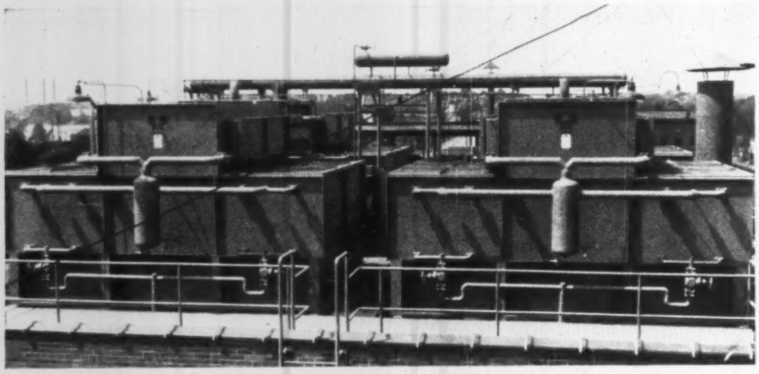
National Airoil

BURNER COMPANY, INC.

Main Office & Factory · **1356 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.**

SOUTHWESTERN DIVISION 2512 SOUTH BOULEVARD, HOUSTON 6, TEXAS

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT



GET TROUBLE-FREE CONDENSING AND GREAT POWER AND LABOR SAVINGS

NIAGARA AEROPASS CONDENSERS give you trouble-free, automatic refrigeration at the least spread between head-pressure and suction pressure. You gain a great power saving. You also get removal of superheat before condensing, condensing at subcooled temperature and a refrigerant fully purged of oil. Out-door air takes up heat of condensation through evaporation of the least amount of water; low temperature condensing means freedom from scaling and loss of capacity. Niagara sectional design offers you lower costs for more compact equipment, easier to keep up. You get always full capacity, "new plant" efficiency and continuous savings such as 95% of condensing water cost that add to your profit. Managers who know their costs buy Niagara Aeropass Condensers.

Write for Bulletin 131

NIAGARA BLOWER COMPANY

Dept. HP-3, 405 Lexington Ave., New York 17, N.Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

EQUIPMENT DEVELOPMENTS

Continued

Explosionproof Control . .

. . . for use in hazardous locations—*Mercoid Corp., Dept. HPAC, 4201 Belmont Ave., Chicago 41.*

Features include: external adjustments for setting operating range; visible calibrated dial; visible hermetically sealed mercury switch; ½ in. external pressure connection with ¼ in. internal pressure connection. Available in 21 operating ranges from zero to 30 in. WG to zero to 1000 psi. Overall size: 7¾ × 9⅞ × 5 in.

Solenoid Valve . . .

. . . in three-way nylon body designed to outlast, outperform steel—*Valcor Engineering Corp., Dept. HPAC, 365 Carnegie Ave., Kenilworth, N. J.*

Nylon port threads of "SV-54" series valve said to outlast steel, also said by manufacturer to be stronger. Nylon is non-corrosive, vibrationproof. Valve available in normally open, normally closed and directional control configurations. Shock-resistant, pressureproof unit available in all normal a-c and d-c voltages.

Equipment Briefs . . .

AIR FILTERING FELT in dacron and orlon—*American Felt Co., Dept. HPAC, Glenville, Conn.* Features cited by manufacturer include: dimensional stability (less than 2½ percent shrinkage); abrasion resistance; uniform air flow; acid-alkali resistance.

EQUIPMENT DEVELOPMENTS

Continued

GAS VALVE LUBRICANT developed to meet many requirements—*Alpha-Molykote Corp., Dept. HPAC, 65 Harvard Ave., Stamford, Conn.* "Type 1102" is high temperature, non-melting-point grease fortified with purified molybdenum disulfide powder. Recommended by manufacturer for use on plug cocks of metal, plastics or glass, or where lubrication in presence of gases or liquids required. Resistant to propane, butane, natural gas, manufactured gas, ethyl alcohol, methyl alcohol, dilute potassium hydroxide, dilute nitric acid, concentrated hydrochloric acid, boiling water, steam.

PIPE JOINT SEALER in rolls of 260 to 520 in. lengths—*Permacel Tape, Dept. HPAC, New Brunswick, N. J.* One 260 in. roll will do up to 100 one in. pipe joints and 520 in. size, up to 200 one in. pipe joints. "Ribbon Dope" is chemically inert, protects pipe joints against corrosive action of chemicals and gases. Can be used on pipes with temperature ranges of −250 to 500 F.

OIL BURNER NOZZLE designed for longer wear and greater filtering area—*Wm. Steinen Mfg. Co., Dept. HPAC, 43 Bruen St., Newark, N. J.* Features cited include: firm seal; cone-shaped wall for easier flow; one-piece construction for easier handling, simple replacement.

GAS CONVERSION BURNER developed to provide thorough heat diffusion in low combustion chambers of boilers—*American-Standard, Plumbing and Heating Div., Dept. HPAC, 40 W. 40th St., New York* 18. Unit injects level flame against horizontally-mounted, adjustable stainless steel spreader. Model "IN" inshot burner designed specifically for company's boilers; may be adapted for use with other boilers, furnaces by sheet metal mounting plate. Effective tube length is 5 in.

AMMETER designed for use with probe where extension of ranges needed—*Pyramid Instrument Corp., Dept. HPAC,* 630 *Merrick Rd., Lynbrook, N. Y.* By using "Deca-tran" with company's model "RS-1 Amprobe" actual current reading of 1000 amp a-c on range of zero to 100 can be obtained. Readings may be taken at conductors or at a distance.

ALUMINUM STRIP in coils up to 60 in. diam—*Bridgeport Brass Co., Dept. HPAC,* 30 *Grand St., Bridgeport* 2, *Conn.* Aluminum strip said to be especially adapted for heat exchanger fin stock, produced to exacting tolerances. Prepainted aluminum strip also available.

LIQUID FLUX developed for torch brazing in production where automatic fluxing systems used—*All-State Welding Alloys Co., Inc., Dept. HPAC,* 24955 *Ferris Ave., White Plains, N. Y.* "Jet Flux" metered out from dispenser into acetylene or propane gas line leading to brazing torch. Product said to eliminate all after-cleaning.

BLACK COATING formulated for protecting metal, wood, or concrete against wide range of exposure conditions—*Maintenance, Inc., Dept. HPAC, Wooster, Ohio.* "Everwear J-41-B" said to form black finish impervious to smoke. Can be used after minimum of surface preparation to preserve or restore appearance. Anti-corrosive coating remains elastic, says manufacturer, permitting expansion and contraction with metal at extreme temperatures.

VACUUM CLEANERS developed for operations such as cleaning, dirt removal applications in heating, ventilating, air conditioning fields—*Dent Co., Dept. HPAC,* 716 *Canal St., Rome, N. Y.* Available in four models, cleaners have tank capacities from 2/3 bushel or 5 gal to 1-2/3 bushel or 10 gal. Dirt and water go into container through intake securely held by suction. Models equipped with 1 hp universal a-c/d-c motor.

WATER TREATMENT formulated so as to have no flash point—*Betz Laboratories, Inc., Dept. HPAC, Gillingham & Worth Sts., Philadelphia* 24. "Betz Neutrameen" is water soluble neutralizing amine developed for control of carbon dioxide corrosion in steam condensate systems. Available as liquid in 55 gal drums, 5 gal pails.

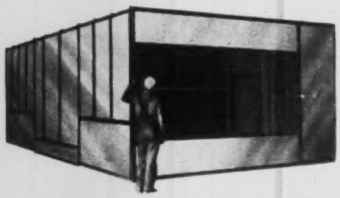
STARTER LOCKOFF designed to provide extra safety—*Square D Co., Dept. HPAC,* 4041 *N. Richards St., Milwaukee* 12. Lockoff arrangment is standard equipment on company's manual starters. Lockoff makes it possible to lock starter in off position without removing cover. Starter unit combines internal lockoff on operating mechanism and external lockoff with cover lockout and button lockoff characteristics.

CONSTANT D-C VOLTAGE SUPPLY developed to provide stable, calibrated d-c voltage without use of standard cells or batteries—*Hays Corp., Dept. HPAC,* 800 *E. Eighth St., Michigan City* 14, *Ind.* Voltage supply designed for use with d-c millivolt receiver; can also be used on other potentiometer type recorders, bridge circuits, industrial measuring potentiometers. Operating from standard 115 volt a-c power source, unit's stability is ± 0.05 percent for ± supply voltage variations; ∓ 0.08 percent maximum drift over 10,000 hr of operation (readjustable).

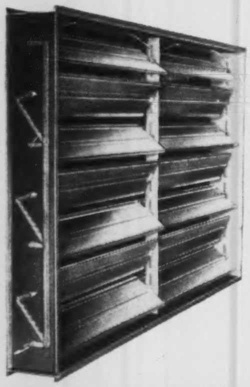
REFRIGERANT CAPS for quick identification of cylinders of refrigerants 12 and 22—*E. I. Du Pont de Nemours & Co., Dept. HPAC, Wilmington, Del.* Gold-colored hood caps and factory-sealed polyethylene valve covers used to seal gas discharge valve for refrigerant identification.

AIR IMPACT WRENCH with 90 psi of air pressure at tool—*Albertson & Co., Inc., Dept. HPAC,* 3100 *Lowell St., Sioux City* 2, *Iowa.* "Model No. 320" ¾ in. wrench rated at 700 ft-lb of torque. Wrench said to be balanced to minimize pull, vibration, shock. ǂ

CAPILLARY ®
Air Washers



ARTICULATED UNITS



LOUVRE DAMPERS

A&R

PRODUCTS
For Air Conditioning
Write for catalog
To —
AIR & REFRIGERATION CORPORATION
439 MADISON AVENUE
NEW YORK 22, N. Y.
ATLANTA, GEORGIA
®TRADEMARK REG.

RECENT TRADE LITERATURE . . .

▶ *AIR CONDITIONING CABINETS*—New 20 page bulletin "AC-220" describes, illustrates air conditioning zone control cabinets. Separate sections of publication give tables, curves and sketches covering proper unit selection, physical data, dimensions, fan performance and coil ratings for water cooling, direct expansion, hot water and steam. *Buffalo Forge Co., Dept. HPAC, 171 Mortimer St., Buffalo 5, N. Y.*

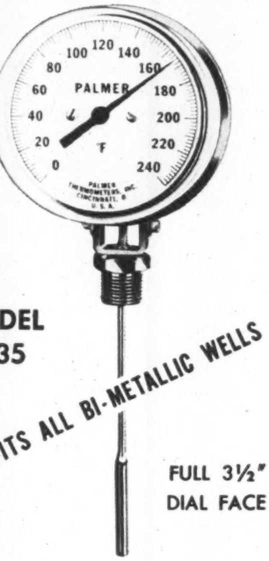
▶ *AIR CONDITIONING MUSEUM*—Brochure prepared by manufacturer describes, illustrates antique features and curiosities of its air conditioning museum. *Recold Corp., Dept. HPAC, 7250 E. Slauson Ave., Los Angeles 22.*

▶ *AIR FILTER*—Bulletin "B-1300-3" describes company's flameproof, tearproof disposable, dry-type filter. Intended for use wherever extra air cleaning efficiency (over 35 percent atmospheric discoloration test) is required. *Farr Co., Dept. HPAC, P. O. Box 90187, Airport Station, Los Angeles 45.*

▶ *AIR FILTERS*—"Bulletin No. 238" describes three types of manufacturer's high efficiency mechanical filters: "Type F," "Airmat Deep Bed," "Multi-Pak." Publication contains illustrations of media and full assemblies. Filter selection tables, charts of engineering data and performance curves also included. *American Air Filter Co., Dept. HPAC, 215 Central Ave., Louisville 8.*

▶ *AIR HANDLERS*—Illustrated 12 page catalog "No. 382A" describes "Model AC" air handlers in capacities 665 to 19,200 cfm. Performance data, specifications, dimensions included. Accessories also covered. *Acme Industries, Inc., Dept. HPAC, 600 N. Mechanic St., Jackson, Mich.*

Outstanding Accuracy
PALMER
Dial Thermometer



MODEL 1035

FULL 3½" DIAL FACE

Check these functional features

- Direct-drive Bourdon Coil with a filled system for longer lasting accuracy.
- Stem can be placed at any desired angle and case can be rotated to most readable position.
- External calibration for zero setting.
- Unaffected by stem alignment.
- Accurate to one scale division.
- No sticking at any temperature.
- Non-corrosive case.

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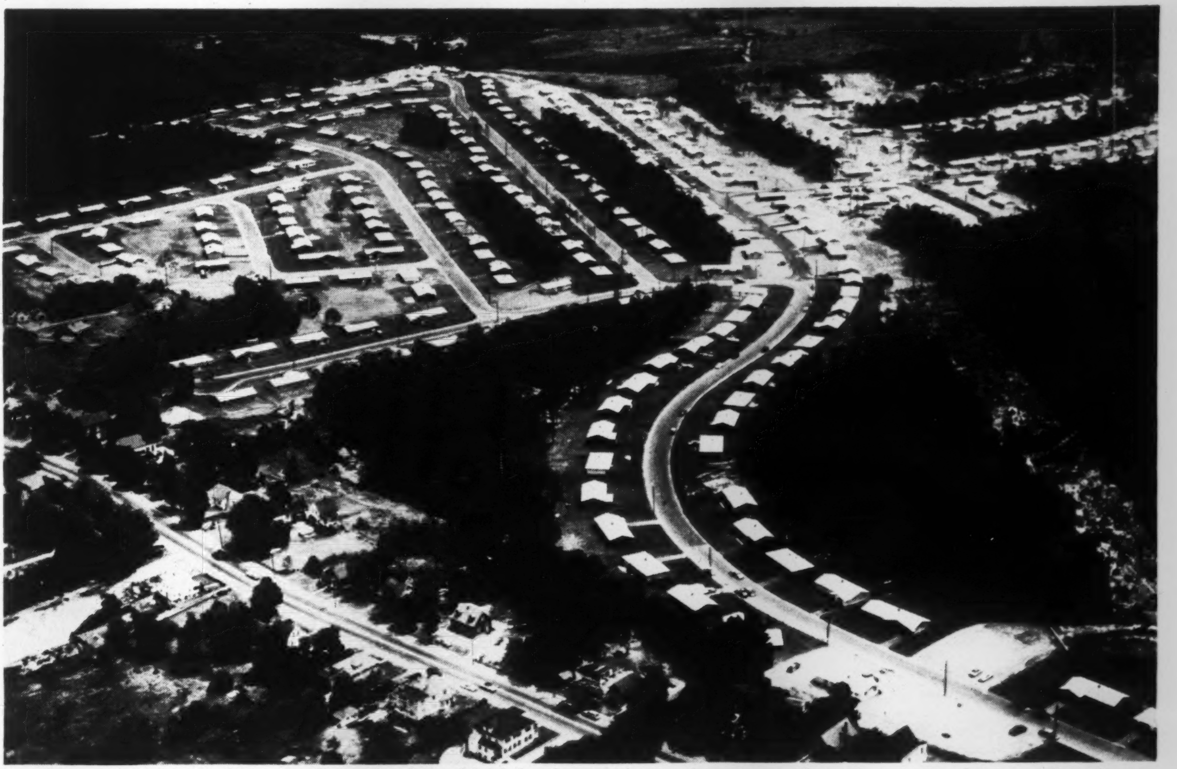
THERMOMETERS, INC.
Mfrs. of Industrial Laboratory,
Recording and Dial Thermometers
2515 Norwood Ave., Cincinnati 12, O.



Aerial view of a portion of Campanelli Brothers' Brookfield development in Brockton, Mass. Photo Eastern Aerial Surveys, Inc., Boston.

Radiant Heat with Anaconda Copper Tube provides superior value in Brookfield Homes

Paul DiNunno (right), plumbing and heating contractor for Brookfield Homes, reviews a radiant panel heating layout with Edward A. J. Poskus (center), the architectural consultant for Campanelli Brothers, and George Benham, sales representative of The American Brass Company.

One of the outstanding housing projects currently under way in New England is "Brookfield," Brockton, Mass., planned and being constructed by Campanelli Brothers of Brockton. The price range is $12,600 to $17,000.

Top value at lowest cost is the aim of the Campanelli firm. All homes, for example, have radiant panel heating systems using copper tube. And, of course, copper tube is also used for all water lines.

The plumbing and heating contractor for the development is DiNunno Inc., of Brockton. Paul DiNunno, president, says: "The plumbing and heating specifications for 'Brookfield' require the very best of workmanship and materials. I can control our workmanship, but not the quality of materials—and that's why I use Anaconda tube. I know I can depend on every length and coil being of the highest quality. I have used about 350,000 feet on this job to date, purchased from your distributor, the Corcoran Supply Co. of Brockton, Inc."

Try Anaconda on your next job and you will see why Paul DiNunno chose Anaconda. Anaconda Copper Tube is available in all standard wall thicknesses—Types K, L, M and DWV (Copper Drainage Tube)—through your plumbing wholesaler. There is also a complete line of Anaconda solder-joint fittings for every kind of plumbing installation.

5916

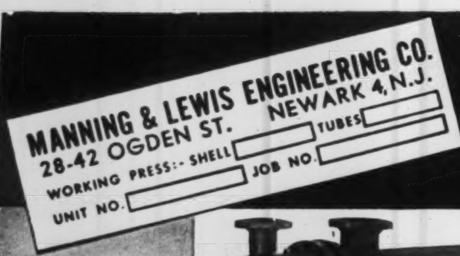
ANACONDA®

COPPER TUBE AND FITTINGS

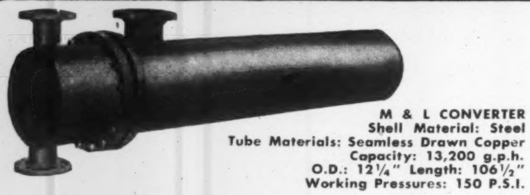
MADE IN U.S.A TO THE STANDARDS OF AMERICAN INDUSTRY

Made by **THE AMERICAN BRASS COMPANY**

Available through Plumbing Wholesalers


MANNING & LEWIS ENGINEERING CO.
28-42 OGDEN ST. NEWARK 4, N.J.
WORKING PRESS:- SHELL
TUBES
JOB NO.
UNIT NO.

FUEL OIL HEATERS WATER HEATERS and COOLERS



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- Heat Exchangers
- Condensate Coolers
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- Instantaneous Water Heaters

M & L CONVERTER
Shell Material: Steel
Tube Materials: Seamless Drawn Copper
Capacity: 13,200 g.p.h.
O.D.: 12¼" Length: 106½"
Working Pressures: 150 P.S.I.

The above unit is one of several M & L Converters now installed at Idlewild Airport in New York. They were designed and fabricated to furnish the heating system of a hangar with water at 140° F.

In order to meet exact specifications, minor changes were made in standard M & L Converters and one more successful installation went into the record.

Our long proven ability to design for a specific need has been extremely helpful in thousands of successful installations all over the country. This service is as near to you as your telephone.

For further details send for your copy of bulletin 780, or we will be happy to send a representative to assist you with any heating or cooling problem.

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M.L

the best things come in small packages

. . . for example, consider the **new, improved** H&M Model "O" — the first pipe cutting and beveling machine especially designed for work on small diameter pipe.

The **new** Model "O", 7½ pounds of precision equipment, makes fast work of cutting and beveling 1½" to 4" pipe. One operator can easily handle this versatile unit, and completely perfect bevels are assured from the moment the torch is fired up . . . even with non-skilled operators.

H&M PIPE BEVELING MACHINE CO.
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The Model "O" is just one of seven H&M machines designed to meet your pipe cutting and beveling needs on 1½" to 36" pipe. Write for illustrated catalog and specification sheets.

The Model "O" features fast, easy mounting. Quick operating snap-chain fasteners make it possible to move the machine in a matter of seconds.

Pat. No. 2813342

311 EAST THIRD ST. Diamond 3-0241
TULSA, OKLAHOMA

RECENT TRADE LITERATURE
Continued

▶ *AIR MOTOR*—"Form 5072A" 16 page bulletin presents over a hundred air motors in company's line. Units cover power range from 0.3 to 24 hp with speeds from 50 to 2850 rpm at rated hp. Eight illustrated case histories included. *Ingersoll-Rand, Dept. HPAC,* 11 *Broadway, New York* 4.

▶ *AUTOMATIC CONTROLS*—Set of application and data sheets comprise revisions and additions to company's "Automatic Controls Application Manual." New set of index tabs for revision of sections also included. *Barber-Colman Co., Dept. HPAC,* 1701 *Rock St., Rockford, Ill.*

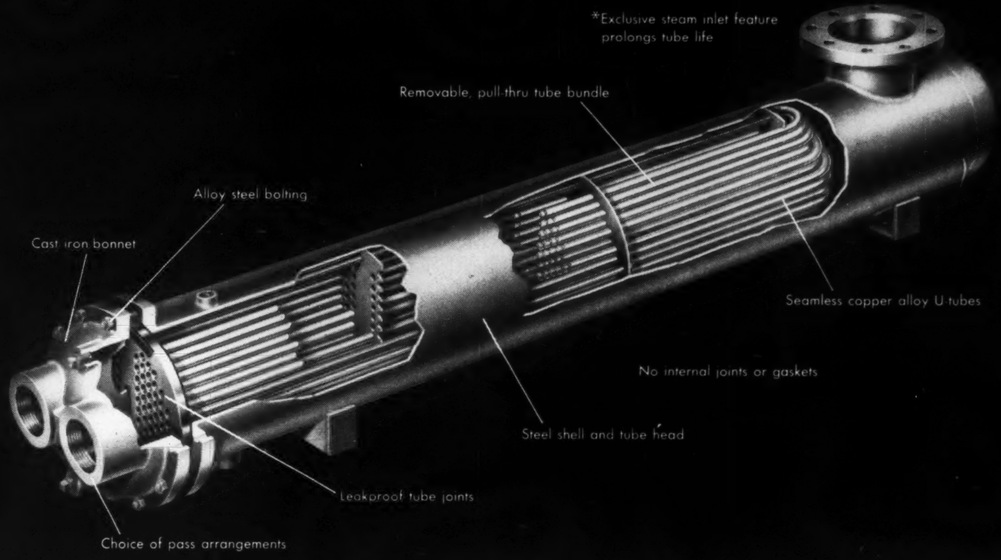
▶ *BEARING SEALANTS*—New brochure presents new techniques for retaining anti-friction bearings with company's sealant. Case histories, description of properties, methods of application included in booklet, with grade selector charts and usage tables. *American Sealants Co., Dept. HPAC,* 491 *Woodbine St., Hartford* 6, *Conn.*

▶ *BOILER SELECTION*—New 20 page guide on boiler selection, complete with 30 illustrations, graphs, covers topics such as: first cost vs. operating costs; fuel selection; construction costs; packaged boiler vs. built-up boiler; boiler design standards; burner efficiency; other subjects. *Cleaver-Brooks Co., Dept. HPAC,* 326 *E. Keefe Ave., Milwaukee* 12.

▶ *COMBINATION BURNERS*—New 8 page bulletin describes company's fuel burning system, lists 11 sizes of oil, gas and combination gas and oil burners for firing boilers, other heat exchange equipment. Cutaway burner views illustrate principles of operation. Typical burner arrangements illustrated throughout. *Orr & Sembower, Inc., Dept. HPAC, Box* 1138, *Reading, Pa.*

▶ *CONCRETE ANCHORS*—Catalog contains complete listing of all types,

for sheer ruggedness, downright economy, top-notch performance and widespread choice


*Exclusive steam inlet feature prolongs tube life
Removable, pull-thru tube bundle
Alloy steel bolting
Cast iron bonnet
Seamless copper alloy U-tubes
No internal joints or gaskets
Steel shell and tube head
Leakproof tube joints
Choice of pass arrangements

there's just no equal to

NEW ROSS INSTANTANEOUS HEATERS

It's a fact: The new line of Ross Instantaneous Heaters packs more benefits than any equipment of its type ever built!

Unsurpassed in efficiency, it is the product of the best heat exchanger engineering brains in the business. For over 40 years, Ross Heat Exchanger (now part of American-Standard* Industrial Division) has been completely dedicated to the design and manufacture of heat transfer equipment.

Rock-bottom in economy, the new line reflects the newest thinking in cost-cutting, time-saving standardization techniques.

Rugged to the core, it is built to ASME Code requirements and utilizes durable materials throughout.

Broad in its range, it provides 128 sizes (2 and 4 pass) to meet virtually every industrial, commercial and institutional water heating requirement: service water, booster, space heating convertor, radiant heating panels and snow melting equipment, swimming pools, storage towers . . . yes, even process work involving other fluids.

*American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

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New bulletin simplifies selection

Brand new, Bulletin 304.4K1 contains complete data and specifications for selecting your own unit . . . and shows you how. Mail the coupon for your copy.

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Send your new Bulletin 304.4K1 describing Ross Type W-100 Instantaneous Heaters.

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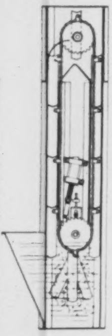
HP 359

News about
AIR FILTERS

SELF-CLEANING AIR FILTER



automatic rotating double-wall panel curtain available with air or electric drive.

The panels in the Automaze curtain type filter are cleaned and recharged automatically with adhesive. A rotating curtain that holds individual panel filters submerges the panels in an oil reservoir on a timed cycle to dislodge and deposit accumulated dirt in the reservoir. As a result, the Automaze stays clean indefinitely to maintain uniform air flow. Goes 3 to 6 months without attention.

HIGH VELOCITY AIR FILTER PANELS

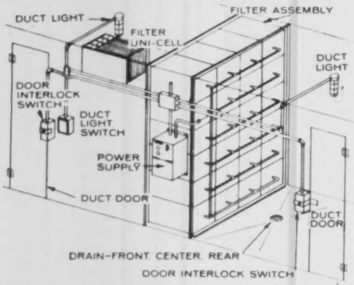
all-metal, permanent, washable panels for ventilating and air-conditioning systems.

Turboflow action of these filter panels handles 50% more air (up to 3 cfm per square inch gross area) than conventional panels, with high filtering efficiency up to 600 fpm face velocity.

This P-5 Air-Maze panel filter has low static pressure drop, extra large dirt-holding capacity, requires less servicing than ordinary filter panels.

HIGH VELOCITY ELECTRONIC AIR CLEANER

for removing dirt particles of sub-micronic size in ventilating and air-conditioning systems.



This two-stage electrostatic air cleaner removes smoke, fumes and carbonaceous matter in particle sizes down to 1/100 micron. Handles 50% more air than conventional designs to conserve space and cost of installation. Dirt-cleaning efficiencies range from 85% to 90% at face velocities up to 600 fpm and up to 98% at lower face velocities. Provisions made for periodic cleaning with automatic semi-automatic or manual washing.

FOR AIR CONDITIONING AND VENTILATING EQUIPMENT, ENGINES, COMPRESSORS *or any device using air or liquids*—there is an Air-Maze filter engineered to solve each filtering problem. For new all-line catalog, write Air-Maze Corporation, Dept. HP-3, Cleveland 28, Ohio.

AIR-MAZE
The Filter Engineers

AIR FILTERS • SPARK ARRESTERS • LIQUID FILTERS
SILENCERS • OIL SEPARATORS • GREASE FILTERS

RECENT TRADE LITERATURE
Continued

sizes of company's self-drilling concrete anchors. Application information included for each type; each type illustrated. Chart shows pull-out and shear loads in pounds. *Phillips Drill Co., Dept. HPAC, U. S. No.* 12 *and Liberty Trail, Michigan City, Ind.*

▶ *CONTINUOUS WELD PIPE*—Complete technical information and specifications on continuous weld pipe contained in new 8 page booklet. Photographs illustrate manufacture of material. Bulletin also contains schematic drawing of production of continuous weld pipe. *Jones & Laughlin Steel Corp., Dept. HPAC,* 3 *Gateway Center, Pittsburgh* 30.

▶ *CONTROL SYSTEMS*—Detailed folder describes company's pre-wired, pre-tested panel control systems for automatic oil, gas or dual-fuel burners in commercial, industrial boiler installations. Included are dimensions, illustrations, selection chart. *Iron Fireman Mfg. Co., Dept. HPAC,* 3170 *W.* 106*th St., Cleveland* 11.

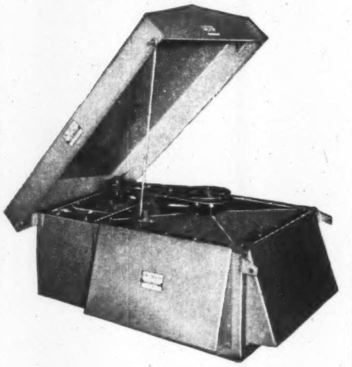
▶ *CONTROLS SYSTEMS*—"Automatic Control Systems" is title of new brochure intended as guide in layout, planning of automatic control systems for most types of heating, ventilating and air conditioning installations. Three parts of brochure discuss features and application advantages, basic types of control, selection. *Barber-Colman Co., Dept. HPAC,* 1701 *Rock St., Rockford, Ill.*

▶ *COOLING COILS*—New bulletin "CWC-200" describes manufacturer's chilled-water cooling coils available in wide range of sizes for central station and zone air conditioning systems. Publication contains charts with complete rating data for selection of proper standard coils for most applications. *Halstead & Mitchell, Dept. HPAC, Bessemer Bldg., Pittsburgh.*

▶ *DEAERATING HEATERS*—Revised, enlarged bulletin, "WC-106A,"

AirMpeler

LO-BOY
CENTRIFUGAL ROOF EXHAUSTERS
Enhance the Beauty of Building Skylines



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Lowest Silhouette Design

Forward or Backward Curve Wheel Within . . . . or Out of Scroll Housing

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

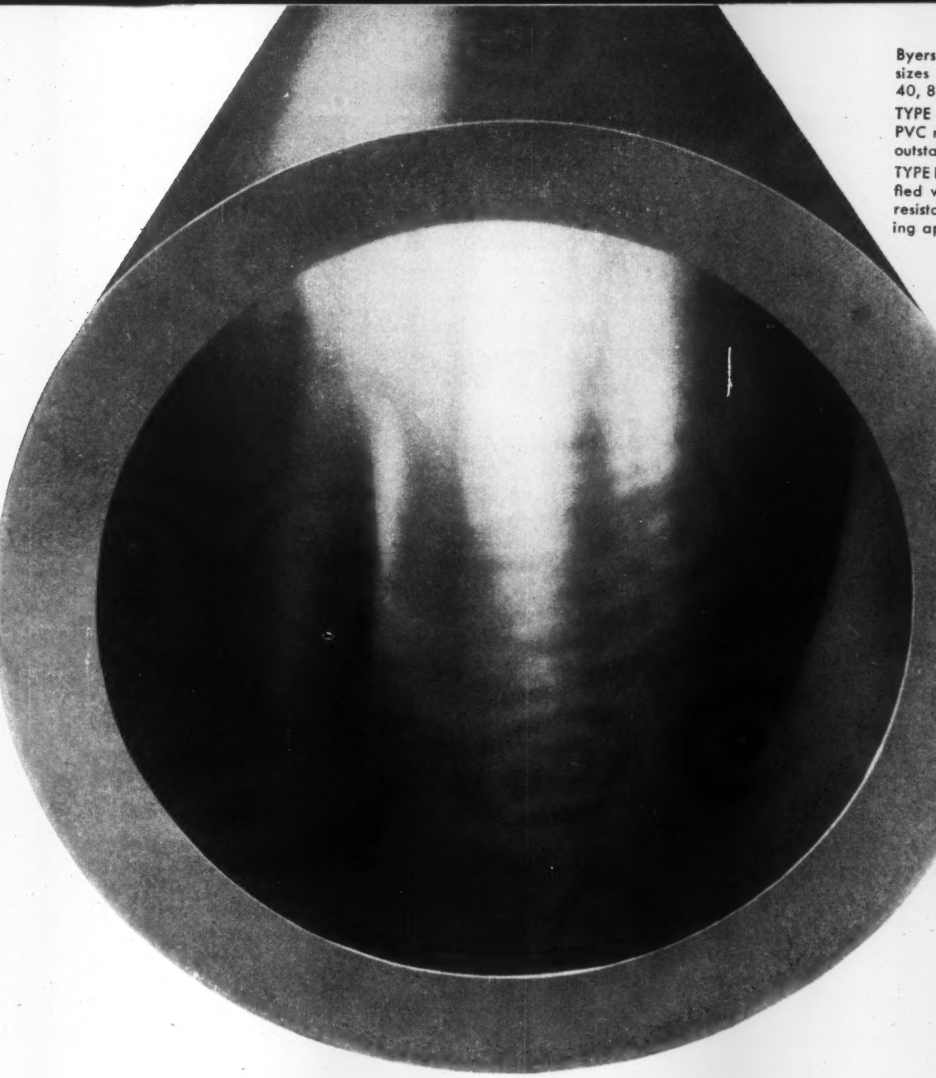
LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- **QUALITY** • **BEAUTY**
- **PROVEN PERFORMANCE**

See Sweet's File 20c/Amm or Write for bulletin HA-100 59

AMMERMAN CO., INC.

P.O. Box 182
Stillwater, Minnesota
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.



Byers PVC Pipe is available i
sizes ¼″ through 6″, in schedules 40, 80, and 120.

TYPE I — compounded of pure PVC resin for normal impact and outstanding chemical resistance.

TYPE II — a similar product modified with rubber for high impact resistance in mechanically punishing applications.

Now you can predict service life because Byers PVC Pipe Engineering brings a factual approach to piping system design

Not for a long, long time has a company been better qualified to talk about its product. The company is A. M. Byers. The product is PVC Pipe. And the qualifications are the factual kind.

More than a product, Byers PVC Pipe is a service. Our recommendations stem from field performance data as well as laboratory test results. Everything we say about our pipe is backed up by actual tests which we have performed with Byers PVC Pipe. We've tested it. We've worked with it. We know what it can do. And what it can't do.

If you'd like to know what we know about PVC pipe — corrosion resistance, flow characteristics, installation data, environmental effects, working pressures — call in your Byers field service representative. A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

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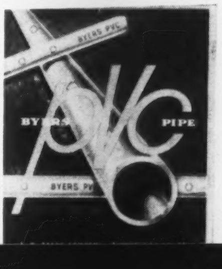
ALSO SHEET AND ROD STOCK



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of constant temperature control

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POWERS No. 11
self-operating temperature regulator

This big four-inch dial gives a quick, visual means of checking controlled temperatures . . . an accurate guide for regulator adjustment.

Designed for precise temperature control, the Powers No. 11 Regulator is self-powered . . . simple, compact and dependable. Full throttling action is gained without the aid of *any* external power source. Special valve stem lubricator eliminates binding. Big double ply metal bellows provide extra valve power — longer life. Union body assures easy installation.

For specifications, valve sizes, types and temperature ranges, call your Powers branch office— engineering services in 66 cities. Write for Bulletins Nos. 329 and 330.

THE POWERS REGULATOR CO., Dept. 359, Skokie 6, Ill.

POWERS
TEMPERATURE CONTROL

RECENT TRADE LITERATURE

Continued

gives details on tray type deaerating heaters. Principles of deaeration, tray heater operation, standard design and applications, accessory equipment and design and fabrication all included. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York.*

▶ *DIRECT FIRED HEATERS*—Illustrated 8 page bulletin gives engineering data on redesigned line of heavy duty space heaters. Construction details, specification data given on 10 models for gas, oil or gas-oil firing ranging in capacity from 400,000 to 2 million Btu per hr output. *Reznor Mfg. Co., Dept. HPAC, 51 Union St., Mercer 8, Pa.*

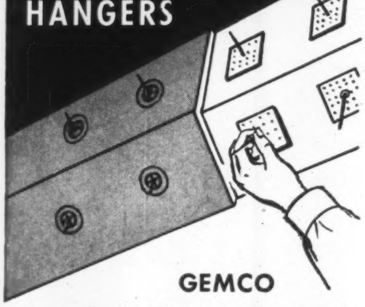
▶ *DRAINAGE SYSTEMS*—New 64 page booklet, "4-D Wrought Iron for Building Drainage Systems," provides comprehensive discussion on piping for waste and vent applications. Graph illustrations, specifying and tabular reference data on company's iron pipe and nipples also included. *A. M. Byers Co., Dept. HPAC, P. O. Box 1076, Pittsburgh.*

▶ *DUST COLLECTOR*—New information sheets available on two cabinet cloth filter dust collectors, models "64" and "65." Photos illustrate internal design, typical applications. Sheets also include multiple rating tables, complete specifications, dimensional drawing. *Torit Mfg. Co., Dept. HPAC, Walnut and Exchange Sts., St. Paul, Minn.*

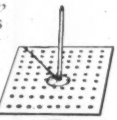
▶ *ELECTRIC BASEBOARD*—Complete specifications and construction, installation data on new electric baseboard heater offered in "Bulletin 1401." New units available in 2, 5, 8 ft lengths in 120, 240 volt power. *Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago 41.*

▶ *FAN UNITS*—New 16 page catalog describes company's expanded line of medium pressure air condi-

SAVE TIME—
SAVE MONEY
with these dependable
INSULATION
HANGERS

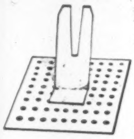


GEMCO
Spindle Hangers and W-A Self-Locking Washers



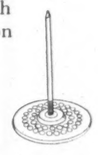
Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed . . . with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.

GEMCO Pronged Hangers



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1³⁄₁₆" to 6⅞") bend over to hold insulation firmly in place.

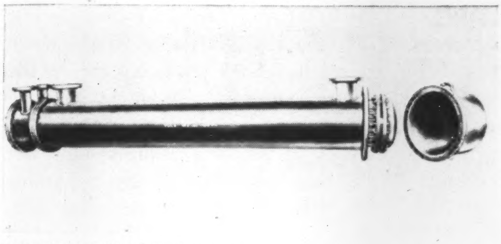
TUFF-WELD Nylon Hangers



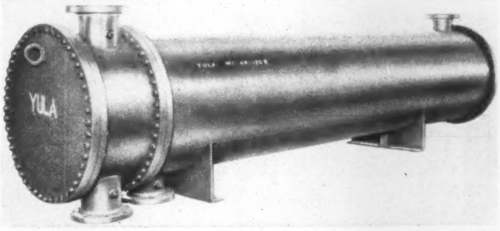
Two-piece hangers . . . with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

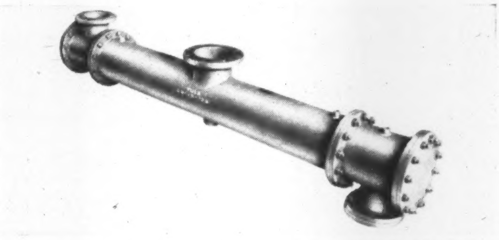
GOODLOE E. MOORE
INCORPORATED
DANVILLE 28, ILLINOIS



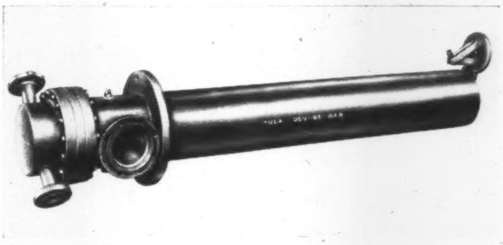
Full Floating Head Exchanger.



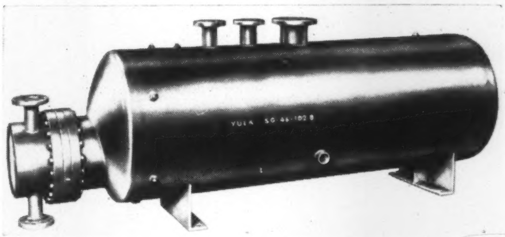
Channel Type Interchanger — for water-to-water application in Air Conditioning.



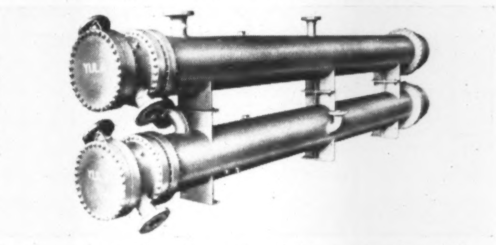
Straight Tube Channel Type Converter — for Heating, Zone Systems, Snow Melting where either steam or water as the heating medium.



Oil Tank Suction Heater with Check Valve.



Unfired High Temperature Hot Water Steam Generator.



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a complete line of heat transfer equipment for every application

Our organization is experienced in the design and fabrication of heat exchangers for commercial, process, chemical, refinery and marine requirements. In addition, we have made a specialty of the application of High Temperature Hot Water as a heating medium through the use of transfer equipment. We are still old fashioned in one respect; that a satisfied customer is valuable. Because of this belief, we offer; quality, fine workmanship, excellent service, free engineering consultation and fair prices. Our shop is A.S.M.E. certified for materials commonly used in fabrication.

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. . . a good man to know!

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Boise, Idaho—Mechanical Equipment & Engr. Co., P. O. Box 1277

Charlotte 1, North Carolina—Mec-Tric Control Co., P. O. Box 209

Cleveland 1, Ohio—Crysler Sales, P. O. Box 5664

Dayton, Ohio—Gary G. Schultz & Associates, 410 W. First St.

Denver 4, Colo.—Herman & Von Rosenberg, 1031 11th Street

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Indianapolis 8, Ind.—Engineering Agency, Inc., P. O. Box 5062

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Knoxville, Tenn.—Tennessee Heating Sales. P. O. Box 391

Louisville, Ky.—R. L. Craig & Associates, P. O. Box 64

Memphis, Tenn.—Mr. James G. Coleman, 2399 Parkway Place

Minneapolis 2, Minn.—A. X. Nelson Co., 1307 Foshay Tower

Nashville 10, Tenn.—Power Specialty Co., 463 Chestnut St.

New Orleans 12, La.—Mr. W. H. Grant, Jr., 209 Vincent Bldg.

Newton, Mass.—Robert Bacon Co., 272 Centre Street

Philadelphia 4, Pa.—Perkins-Lenoir Co., 400 Wilford Bldg.

Pittsburgh 27, Pa.—Mr. Wm. Goodridge, P. O. Box 9820

Portland 4, Oregon—Mead and Associates, 317 S. W. Alder St.

Rockford, Ill.—Mr. John Mucha, 122 South London Avenue

South Charleston, W. Va.—Mechanical Products Co., 702 Jefferson Rd.

Tampa 3, Fla.—Mr. Bernard A. Thomas, 2925 W. Hillsborough Avenue

Torrance, Calif.—The A C Company, P. O. Box 281

Westerfield, Conn.—Geo. W. McGrath, 1016 Follybrook Blvd.

YULA CORPORATION

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330 BRYANT AVENUE, NEW YORK 59, N.Y.
MEMBER FUEL OIL AND WATER HEATER MANUFACTURERS ASSOCIATION

Products that Call for
HEATING
or
COOLING
Call for
G&O

...THE
GREATER-HEAT-TRANSFER,
EXTENDED-SURFACE TUBING
★ known for reliability since 1915 ★

Individual Fin Tubing
Square Fin, Continuous, Return Bend Coil
Square Fin, U-Bend Tubing
Unit Heater Coil
Continous Strip Fin, All-Aluminum Cooling Coil

- Tubes & Coils
- Individual finned tubing in standard sizes, square or round fins of any height or spacing
- Straight lengths, U-bends, continuous return-bend; special shapes
- Single pass, header-to-header
- Simple to install
- Free design assistance
- Write for catalog

"If it's to transfer heat, G & O can't be beat"

THE **G&O** **Mfg. Co.**
139 Winchester Ave.
New Haven, Conn.
•
1420 Ridgeway St.
Jackson, Miss.

G&O RADIATION

RECENT TRADE LITERATURE

Continued

tioning units. Publication covers company's line of 1, 2 and 3 fan assembly units ranging from 500 to 50,460 cfm at SP to 3 in. Construction features, accessories illustrated. Capacities, dimensions of 39 sizes in horizontal, vertical models covered. *M. Blazer & Son, Dept. HPAC, 173 Market St., Passaic, N. J.*

▶ *HEAT GAIN CALCULATOR*—Tool operates on slide rule principle to determine heat gain Btu per hr per sq ft of window area due to directly transmitted solar, sky radiation plus energy admitted to room after absorption in glass of both sun and sky radiation. Available at 50c from: *Libbey-Owens-Ford Glass Co., Dept. HPAC, 608 Madison Ave., Toledo 3.*

▶ *HEATING AND VENTILATING UNITS*—Illustrated bulletin "No. 910" describes complete line of "Herman Nelson" heating and ventilating units in nine sizes from 600 to 73,000 cfm. Bulletin gives information on coil selection for both steam and hot water. Capacity tables, air resistance charts, rpm and hp tables given. *American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

▶ *INERT GAS ARC WELDING*—New 8 min sound, color 16 mm. motion picture gives orientation in "Heliarc" inert gas arc welding process. Movie shows basic pieces of equipment and their relationship and how to make a simple weld. *Linde Co., Div. of Union Carbide Corp., Dept. HPAC, 30 E. 42nd St., New York 17.*

▶ *MOTOR APPLICATION GUIDE*—New 16 page guide, "Form 270 A," has been expanded to include more information about the manufacturer's motors and their applications. Polyphase, single phase and direct current motor selection charts given. Gearmotor line, selective speed drives, mechanical variations, special applications also described. *Century Electric Co., Dept. HPAC, 18th and Pine Sts., St. Louis 3.*

▶ *MOTOR MAINTENANCE*—New 24 chapter, 650 page maintenance hints handbook published to provide quick, complete, convenient guide to modern maintenance practices on all types of electrical equipment. First 17 chapters cover specific apparatus maintenance; last seven cover general maintenance of materials used in apparatus, such as insulation. Available at $2.00 from: *Westinghouse Electric Corp., Dept. HPAC, P. O. Box 2099, Pittsburgh 30.*

▶ *MULTIZONE UNITS*—"Multizone Air Distributing Units" is title of catalog "1635-B" describing company's complete line of blowers for multizone central air conditioning systems. Performance, application data given, including construction details, dimensions, typical specifications. *Westinghouse Sturtevant Div., Dept. HPAC, 200 Readville St., Hyde Park, Boston 36.*

▶ *NOISE CALCULATOR*—Fan noise calculator combines several acoustical formulas to give accurate predictions of room noise levels resulting from fan additions. Calculator can also be used for other equipment having noise spectrum similar to that of most rooms and a known sone rating. *Propellair Div., Robbins & Myers, Inc., Dept. HPAC, 1345 Lagonda Ave., Springfield, Ohio.*

▶ *NON-FERROUS TUBING*—"The Measure of Tubemanship" is title of new brochure intended to acquaint industry with techniques of manufacturing seamless copper and copper alloy tubing. *Wolverine Tube, Div. of Calumet & Hecla, Inc., Dept. HPAC, 17200 Southfield Rd., Allen Park, Mich.*

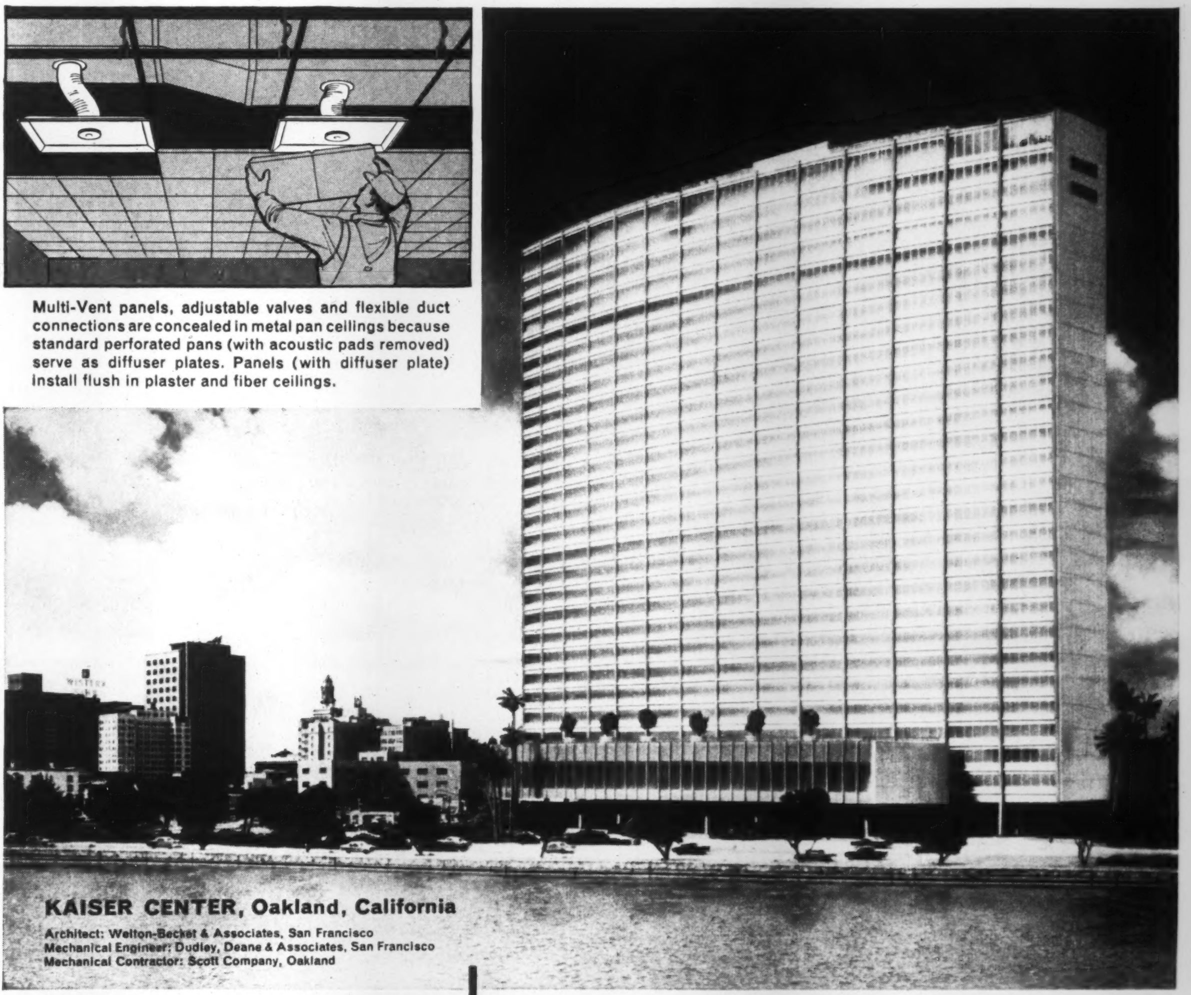
▶ *PANCAKE MOTOR*—New 4 page bulletin "No. 2150" describes company's new dripproof pancake motor. Full engineering information on flange type motor given. Cutaway drawing shows how motor achieves short length through formed end coils and one-piece housing bracket. *Louis Allis Co., Dept. HPAC, 427 E. Stewart St., Milwaukee 1.*

MULTI-VENT®

low velocity air diffusers specified for the West's largest office building

Multi-Vent will handle the air distribution in over 70% of Kaiser Center's office building, the largest west of the Mississippi, scheduled for completion late in 1959.

Multi-Vent is the ideal air diffuser for office space because it need never be moved, or even adjusted when partitions are relocated. Distributing air at low velocities by gentle pressure displacement, Multi-Vent provides truly sightless, soundless, imperceptible air conditioning comfort, unmatched by any other diffuser.



Multi-Vent panels, adjustable valves and flexible duct connections are concealed in metal pan ceilings because standard perforated pans (with acoustic pads removed) serve as diffuser plates. Panels (with diffuser plate) install flush in plaster and fiber ceilings.

KAISER CENTER, Oakland, California

Architect: Welton-Becket & Associates, San Francisco
Mechanical Engineer: Dudley, Deane & Associates, San Francisco
Mechanical Contractor: Scott Company, Oakland

Recent Multi-Vent Installations Coast to Coast

Banker's Trust, New York City
Baptist Tabernacle, Atlanta
Boeing Airplane Co., Seattle
Ford Motor Co., 21 Buildings
Graybar Electric, Illinois
Inland Steel Building, Chicago
National Bank of Detroit, Detroit
Parke Davis Bldg. 64, Detroit
Procter & Gamble Tech. Center, Cincinnati
Prudential Insurance Co., Newark
Travelers Insurance Co., Hartford

Write for detailed literature.

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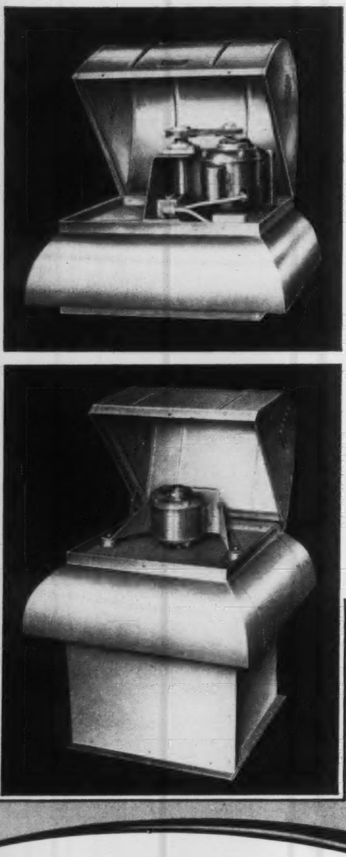
MULTI-VENT DIVISION
WHERE QUALITY IS TRADITIONAL
1373 N. Kostner Avenue, Chicago 51, Illinois

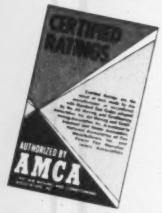
SALES AGENTS IN PRINCIPAL CITIES OF THE UNITED STATES AND CANADA



Aladdin
AIR HANDLING EQUIPMENT

ROOF VENTILATORS

- **THIRTEEN SIZES**
- **SELF CONTAINED**
- **QUIET OPERATING**



ALADDIN Type V Roof Ventilators are available in a complete range of sizes . . . direct and belt driven. Units can be furnished in both curb mounted or extended base types. Ruggedly built, the type V units have been designed for those installations where positive year around powered ventilation is required, and when properly installed, will give years of efficient trouble free service.

Write for complete data **4**

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

RECENT TRADE LITERATURE

Continued

▶ *PIPE MACHINE FILM*—"Breaking the Price Barrier" is title of new 16 mm full color sound film presenting time-, cost-, work-saving advantages of "100" power drive. Film has been cleared for TV. Running time is 14 minutes. *Oster Mfg. Co., Dept. HPAC, E. 289th St. and Nickel Plate RR, Wickliffe, Ohio.*

▶ *PLASTIC WELDER*—High speed hand welders for thermoplastics pictured, described in new 4 page bulletin. Information on welding speeds, strengths and characteristics of construction included. *Laramy Products Co., Dept. HPAC, 90 South St., Hingham, Mass.*

▶ *REDUCING VALVE*—Catalog sheet describes company's "Fig. 1910 Type E" reducing valve for initial pressures to 300 psi with gas, oil or water. Outlet or regulated spring ranges are 5-35, 20-60 and 40-90 psi. Sheet includes features, description, operating and ordering information, valve drawing and photo, dimensions, parts list. *Atlas Valve Co., Dept. HPAC, 280 South St., Newark 5, N. J.*

▶ *SPREADER STOKERS*—Detailed information on company's "Series 401" pneumatic spreader coal stokers given in new 12 page booklet "2530." Publication illustrated with cutaway views, installation photographs, diagrams. *Iron Fireman Mfg. Co., Dept. HPAC, 3170 W. 106th St., Cleveland* 11.

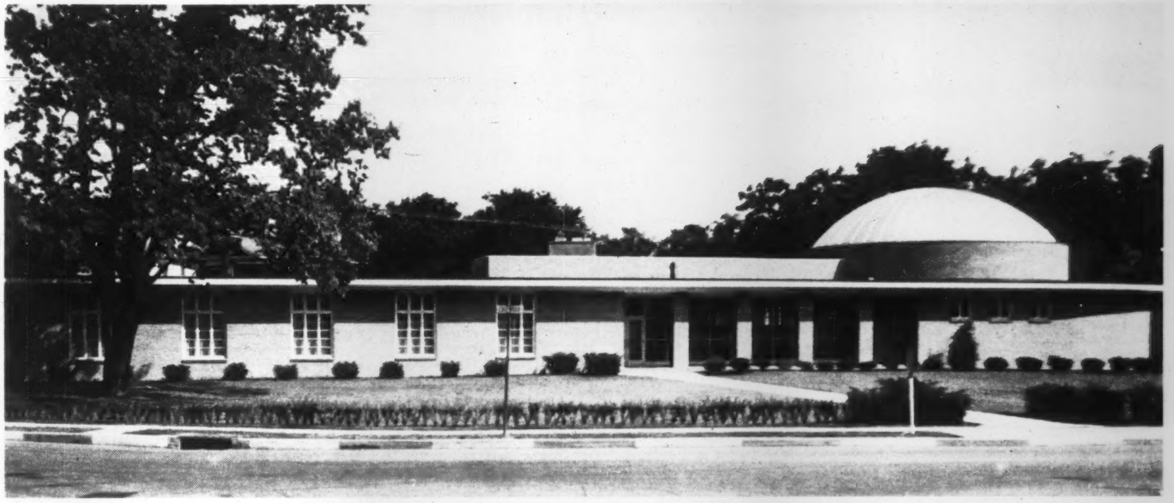
▶ *STAINLESS STEEL PRODUCTS*—Complete 159 page reference manual, entitled, "Buyers' Guide for Stainless Steel Products and Services," contains 188 specific and general stainless steel product categories with manufacturers' names and locations. Table gives names, addresses of mill suppliers and mill forms and shapes they produce. *Committee of Stainless Steel Producers, American Iron and Steel Institute, Dept. HPAC, 150 E. 42nd St., New York* 17.

▶ *STAINLESS STEEL VALVES*—Complete line of company's stainless steel gate, globe and swing check valves is presented in new catalog, "No. 59 SS." Catalog also has 10 page section showing degree of resistance of company's alloys to corrosive media under varying conditions. *Jenkins Bros., Dept. HPAC, Room* 133, 100 *Park Ave., New York* 17.

▶ *STAINLESS VALVES*—Technical bulletin "No. 8" describes "Aloyco 20," special austenitic stainless steel recommended for valving sulfuric acid, other severely corrosive liquids. Bulletin includes cross-sectional views, graph. *Alloy Steel Products Co., Inc., Dept. HPAC, 1322 Elizabeth Ave., Linden, N. J.*

Campbell

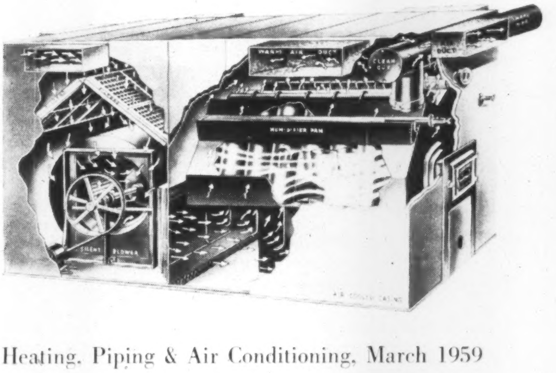
WARM AIR HEATERS FOR LARGE BUILDINGS



Temple Le Shem Shomayim, Wheeling, W. Va., heated with a Campbell #8075 gas-fired unit. Architects, Cantor and Friedman, Pittsburgh, Pa.; Heating contractor, Schenerlein Roofing & Supply Co., Wheeling, W. Va.

LOW COST CHURCH HEATING

Campbell Warm Air Heaters meet every requirement for church heating at very low cost. They provide fast heat delivery; positive control of temperature, humidity and ventilation; quiet operation, and exceptional fuel economy. Campbell Heaters are compact, easy to install and surprisingly low in cost. Available for all fuels in capacities up to 3,150,000 BTUs.



MANUFACTURERS' AGENTS

We have some attractive openings for men calling on heating contractors and architects.

CAMPBELL
HEATING COMPANY

DES MOINES 17, IOWA

RECENT TRADE LITERATURE
Continued

▶ *STAINLESS WELDING FITTINGS*—Dimensional data on company's full line of stainless steel welding fittings and flanges contained in revised catalog "TT600". New 54 page booklet includes updated technical data, allowable working pressures of fittings, pressure-temperature rating of flanges and corrosion resistance information. Suggested applications also presented. *Tube Turns, Div. of Chemetron Corp., Dept. HPAC, 224 E. Broadway, Louisville 1, Ky.*

▶ *STEAM GENERATORS*—New 6 page promotional color folder, entitled, "More Performance from Less Investment," describes manufacturer's line of 18 sizes of package steam generators in range from 15 to 650 hp. Specifications on 10 sizes of package hot water generators with range 670 to 6700 Mbh also included. Publication illustrated with photos, diagrams. *Cyclotherm Div., National-U. S. Radiator Corp., Dept. HPAC, 157 E. First St., Oswego, N. Y.*

▶ *THERMOSTAT METALS*—Technical data bulletin presented by manufacturer to help determine correct thermostat-metal element size, properties for new applications. Publication said to contain graphical solutions accurate enough for first sample determinations. Table gives company's thermostat metal types, their thermal deflections, mechanical and restrained forces. *Metals & Controls Corp., General Plate Div., Dept. HPAC, 34 Forest St., Attleboro, Mass.*

▶ *TUBE EXPANDER*—Data on complete line of "Torq-Air-Matic" automatic tube expander drives, including recently added heavy duty models, provided in new illustrated 6 page bulletin. Reference chart for selection of equipment included. *Thomas C. Wilson, Inc., Dept. HPAC, 21-11 44th Ave., Long Island City, N. Y.*

▶ *VACUUM CLEANING SYSTEMS*—New 8 page brochure, "Catalog No. 160," gives details on installed vacuum cleaning systems for use in schools, office buildings, hotels, other institutional, commercial buildings. Included in brochure are details of system, illustrations, diagrams. *Spencer Turbine Co., Dept. HPAC, 486 New Park Ave., Hartford, Conn.*

▶ *WATER TREATMENT*—Suggestions for winter layup of air conditioning systems is the subject of technical bulletin. Leaflet describes several procedures intended to insure trouble-free startup in spring. *Water Service Laboratories, Inc., Dept. HPAC, 615 W. 131st St., New York.*

▶ *WATER TREATMENT*—"Technical Reprint T-167", entitled, "Russian and Eastern European Water Treatment Practices," gives full report on subject of water treatment behind the iron curtain. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York 11.*

Quick case history—reading time 42 seconds

How 2560 tons of cooling equipment resist corrosion with Hagan CS

THE PLANT: 42-story office building at 525 William Penn Place, Pittsburgh. Hot-chilled water circulating systems contain steel risers, copper runouts, brass automatic valves; air condition 13,500,000 cubic feet of office space; circulate 14,000 gallons of water.

THE PROBLEM: Find a corrosion-inhibiting chemical to protect these 2560 tons of refrigeration machinery. Chemical must be effective for both ferrous and non-ferrous metals, easy to handle, easy to feed, non-injurious to packing or pump seals, non-staining to painted surfaces should closed loops leak.

THE SOLUTION: Hagan Corrosion Inhibitor CS meets all specifications; is added through conveniently located pressure pot feeders. Simple colorimetric control test tells when to add to compensate for minor leakage through glands and packings. The hot and chilled water systems treated with CS have required practically no maintenance.

TEST RESULTS: Standard 1 x 2 inch pre-weighed corrosion test specimens installed at critical locations throughout system showed these typically low corrosion rates (mg/dm²/day) after introduction of CS Inhibitor:

Steel:	0.010
Copper:	0.004
Brass:	0.008

FOR FULL INFORMATION on how economical Hagan Corrosion Inhibitor CS can help keep your closed water system corrosion free, write for Bulletin 410-12-3.

HAGAN CHEMICALS & CONTROLS, INC.
DIVISIONS: CALGON COMPANY, HALL LABORATORIES
HAGAN BUILDING, PITTSBURGH 30, PA.
In Canada: Hagan Corporation (Canada) Limited, Toronto

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hunger hurts!

FOOD from America's farm abundance . . . milk powder, flour, cornmeal, cheese . . . is given to CARE, by the U.S. Government . . . for relief distribution in less fortunate lands. These foods are allocated after all requests from qualified U.S. relief programs have been met.

FOR every $1 you give, CARE can pack and deliver one Food Crusade package (average, 22 lbs.) to those who need food most in critical areas of Asia, Europe, the Middle East and Latin America.

HUNGRY children and their parents, orphans, refugees, the aged and sick are reached by distributions made directly to needy families or to schools, hospitals and welfare institutions.

PEOPLE who otherwise would never get enough to eat receive this food as your personal gift: your name and address, or that of your group, go with each package, to tell them that you and our country are their friends. Send as many dollars as you can to join the people-to-people Food Crusade!

Every $1 sends 22 lbs.
. . . $100 sends a ton of food

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You may select the countries from those listed above.

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Enclosed is $________ to send Food Crusade packages to the needy.
(Make checks payable to CARE, Inc.)

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City________________ Zone____ State________

CARE Food Crusade contributions are income tax-deductible (Federal).
343

WHO'S WHAT . . .

(New personnel, promotions)

- *NIAGARA BLOWER CO.*—Paul H. Schoepflin, chairman of the board and chief executive officer.

- *DURANT MFG. CO.*—Roger D. Williams, president; William D. Richards, executive vice president.

- *PENNSYLVANIA PIPE SUPPLY CORP.*—Louis Alexander, president.

- *PHELPS DODGE COPPER PRODUCTS CORP.*—Edward H. Michaelsen, vice president in charge of international activities.

- *RUBEROID CO.*—Richard N. Funkhouser, vice president.

- *KEASBEY & MATTISON CO.*—D. W. Widmayer, vice president, marketing consultant; Norman L. Barr, general sales manager of sales division; James R. Reichel, general sales manager of asbestos-cement pipe division.

- *AUSTIN CO.*—L. Paul Gilmore, vice president-secretary-treasurer, elected to board of directors; James R. Stewart, general counsel, elected to board of directors; A. T. Waidelich, vice president and director of engineering and research, elected to board of directors.

- *SWARTWOUT CO.*—G. V. Patterson, vice president.

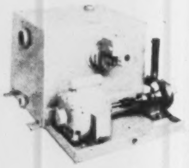
- *AIR REDUCTION SALES CO., DIV. of AIR REDUCTION CO. INC.*—Dr. Albert Muller, vice president.

- *JOHNS-MANVILLE CORP.*—Clinton F. Hegg, assistant to the vice president for sales.

- *EUTECTIC WELDING ALLOYS CORP.*—L. D. Richardson, assistant vice president and field sales manager.

- *MORRISON PRODUCTS, INC.*—Peter Kardos, chief engineer.

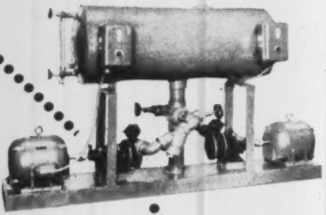
- *CAMBRIDGE FILTER CORP.*—Donald E. Wendel, sales manager.



EAGAN EAGLE
—For steam heating loads up to 8000 sq. ft. at 20 p.s.i. Does not require pit even though return lines are no more than one foot above the floor.

EAGAN HOT POT —Vertical submerged type pump with cast iron receiver. Motor and pump above receiver safe from flooding. Single and duplex construction. Models for loads up to 15,000 sq. ft. at 20 p.s.i.

TYPE ECIV —Vertical pump and receiver for installations where return lines are below floor levels. Single or duplex units. Models up to 10,000 sq. ft. capacity at 60 p.s.i.



TYPE EC
—Straight line arrangement requiring less floor space than necessary for competitive makes. Both pumps accessible for maintenance purposes. Single and duplex models designed for 2000 to 100,000 sq. ft. discharging against pressures of from 10 to 200 p.s.i.

EAGAN...

the complete line of Condensate Return Pumps

Eagan offers a full line of Condensate Return Pumps, and also manufactures Fuel Oil Pump and Heater Sets, Proportioning Pumps, Turbine Pumps and Centrifugal Pumps.

WALTER H. EAGAN CO., INC.
Pump Specialists Since 1920
2336 Fairmount Ave., Dept. HPAC, Phila. 30, Pa.

Gentlemen:
Send me complete information on the EAGAN Line of Condensate Pumps.

COMPANY ....
NAME ....
ADDRESS ....
CITY .... ZONE .. STATE ....

WHO'S WHAT

Continued

▶ *REYNOLDS METALS CO.*—Keith E. Hall, general manager of industrial market sales, and Alfred H. Williams, Jr., general manager of architectural and building products sales, both named vice presidents of *REYNOLDS ALUMINUM SALES CO.*

▶ *DRAVO CORP.*—Clyde H. Slease, assistant to the president and counsel, transferred to Washington, D. C., to coordinate sales activities and handle liaison with governmental agencies; Walter L. Threadgill, plant engineer of the engineering works division in Pittsburgh.

▶ *RUBEROID CO.*—Rhys L. Stanger, manager of asphalt and asbestos products sales.

▶ *UNITED STATES STEEL CORP., NATIONAL TUBE DIV.*—James P. Bacon, manager of tubing specialties products; James H. Degnan, manager of oil country tubular products; George O. Nations, manager of standard pipe products.

▶ *YOUNGSTOWN SHEET AND TUBE CO.*—Thomas G. Lewis, purchasing agent; William B. Seeman, group leader, buyer.

▶ *EASTMAN KODAK CO.*—Phil T. Elliott, director of the engineering division; Harold A. Mosher, associate director; Kenneth W. Brenner, assistant director.

▶ *A. M. BYERS CO.*—E. P. Best, director of metallurgy and research; T. D. Bonner, chief wrought iron metallurgist.

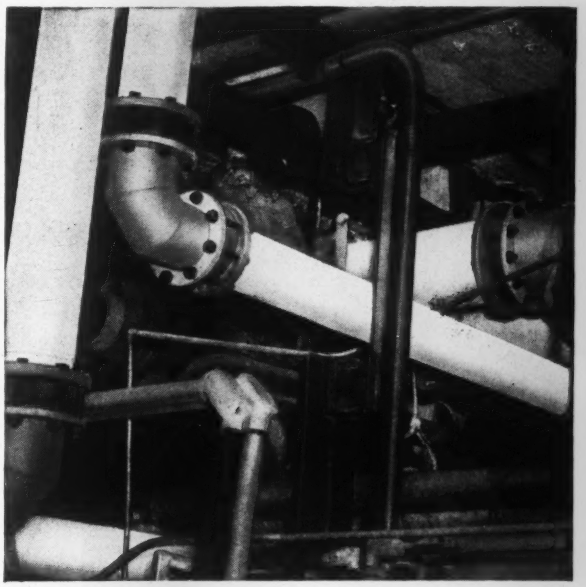
▶ *YORK DIV. of BORG-WARNER CORP.*—Robert A. Halla, director of new marketing services section; Oscar E. Fox, manager of quality control and inspection.

▶ *FUEL ENGINEERING CO., INC.*—Paul Mulcey, associate.

▶ *MILTON ROY CO.*—Arthur B. Beetle, instruments product manager.

▶ *GENERAL FITTINGS CO.*—Vaughn G. Gooding, general sales manager.

▶ *CHASE BRASS & COPPER CO.*—Paul M. Thomas, manager of mill sales; Henry F. O'Shaughnessy, works manager; David M. Andrews, general superintendent of company's plant in Waterville, Conn.



"Of the 4 stockline materials we've used . . . we rate Transite best in economy, workability, and resistance to stock build-up!"

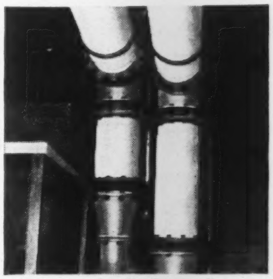
Says Mr. R. P. McGinley, Plant Engineer, The Missisquoi Corp.

Until 1955, the Missisquoi Corporation, Sheldon Springs, Vermont, had never used Transite® Pipe. Earlier installations of three other materials had proved unsatisfactory, either from an economic or service standpoint.

"It became necessary," says Mr. R. P. McGinley, Plant Engineer, "to think of another pipe material because of the cost, weight and handling difficulty of one material, and the excessive cost of the second. A third had also been tried, but because of the acidity of some of our furnishes, this type of pipe had not proved satisfactory for long service."

Then, in 1955, Missisquoi used 200 feet of 6″ Transite Pipe as part of a new distribution box system.

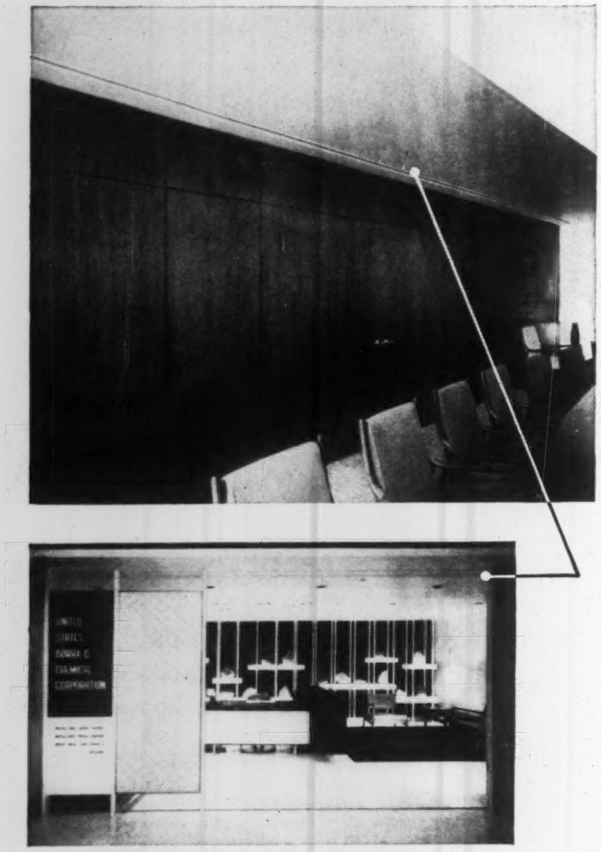
"During the following year," continues Mr. McGinley, "we watched Transite's performance closely, and were pleased to note that its service was entirely satisfactory. It showed no build-up of stock in lines, resisted acidic conditions satisfactorily, and withstood normal vibrations. Since that time we have installed about 1,000 feet of six-, eight-, ten-, and twelve-inch pipes on various stock lines, including discharge from reciprocating pumps, and have been very satisfied with the service received from it."



"Transite is the best pipe we ever had," says Paul Gonyeau, Missisquoi's Chief Piper. "It stays clean, doesn't corrode out, handles easily."

Performance like this throughout the pulp and paper industry makes Transite well worth your investigation. Let us send you TR-113A, 24-page brochure and TR-180A, Transite installation guide. Write, today, to Johns-Manville, Box 14 HP, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS



Designer:
Maria Bergson Associates

STRIPLINE

Distinctive SLOT TYPE Diffusers

Look around . . . you'll see STRIPLINE by AGITAIR everywhere. And no wonder. STRIPLINE combines the best features of both slots and efficient air diffusers to provide equalized air flow throughout its entire length.

Slender, inconspicuous, practical and versatile . . . STRIPLINE slot diffusers can be located in walls, ceilings, coves, moulds, window reveals, stools . . . yes anywhere to suit interior design.

Write for Complete Stripline Catalog

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high velocity units • punkah louvers
air diffusers • filters • exhausters

Sold exclusively by representatives for:

AIR DEVICES INC.

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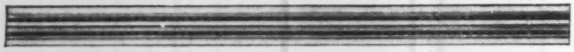


WHO'S WHAT

Continued

▶ *INDUSTRIAL COMBUSTION, INC.*—F. M. Jordan, recently joined company's sales department.

▶ *KEASBEY & MATTISON CO.*—George W. Lumpe, joined industrial relations department to assist in establishment of formal job evaluation program and personnel policy; Willard Davis, new process and new product development department.

▶ *MARION ELECTRICAL INSTRUMENT CO.*—Carl A. Anderson, general manager.

▶ *MAMMOTH FURNACE CO.*—James H. Collins, general sales manager.

▶ *ARMCO STEEL CORP.*—Edward K. Barney, assistant to general superintendent of Baltimore Works.

▶ *DRAVO CORP.*—Walter L. Davidson, sales manager of engineering works division; Robert W. Hiller, assistant to general manager of engineering works division.

▶ *ROBERTS-GORDON APPLIANCE CORP.*—Henry K. Straw, general sales manager.

▶ *COCHRANE CORP.*—George E. Glover, manager of industrial waste department.

▶ *WORTHINGTON CORP.*—Patrick L. McManus, assistant manager—marketing division and eastern regional sales manager; Jack B. Laramy, manager of sales; I. J. Karassik, consulting engineer and manager of planning.

▶ *A. O. SMITH CORP.*—Archie C. Anderson, technical director of reinforced plastics division.

▶ *DOLE REFRIGERATING CO.*—A. J. Lane, international director of *REFRIGERATION SERVICE ENGINEERS SOCIETY.*

▶ *TRIANGLE MFG. CO.*—Courtland F. Carrier, sales manager.

▶ *W-K-M, DIV. of ACF INDUSTRIES, INC.*—Robert D. Butler, sales manager—plug valves.

▶ *COMBUSTION ENGINEERING, INC.*—Nelson Stuart, assistant sales manager of soil pipe division.

WHO'S WHAT

Continued

▶ *FLEXAUST CO., DIV. of CALLAHAN MINING CORP.*—H. Stanley Johnson, general sales manager.

▶ *DETROIT CONTROLS DIV., AMERICAN STANDARD*—John S. Amneus, manager of research and advanced development; Richard L. Campbell, divisional director of engineering; Thomas E. Noakes, chief engineer.

▶ *DOLE VALVE CO.*—John Gayton, director of marketing.

▶ *WALWORTH CO.*—Harold Brown, general sales manager.

▶ *ALUMINUM CO. OF AMERICA*—M. M. Anderson, vice president, elected president of the *ALUMINUM ASSOCIATION*.

▶ *WORTHINGTON CORP.*—Matthew M. Lawler, vice president, chairman of air conditioning division of Muscular Dystrophy Associations of America, Inc.

▶ *LINDE CO., DIV. of UNION CARBIDE CORP.*—Claude E. Monlux, elected president of the *COMPRESSED GAS ASSOCIATION INC.*

▶ *PURE CARBONIC CO., DIV. of AIR REDUCTION CO., INC.*—George C. Cusack, elected first vice president of *COMPRESSED GAS ASSOCIATION, INC.*

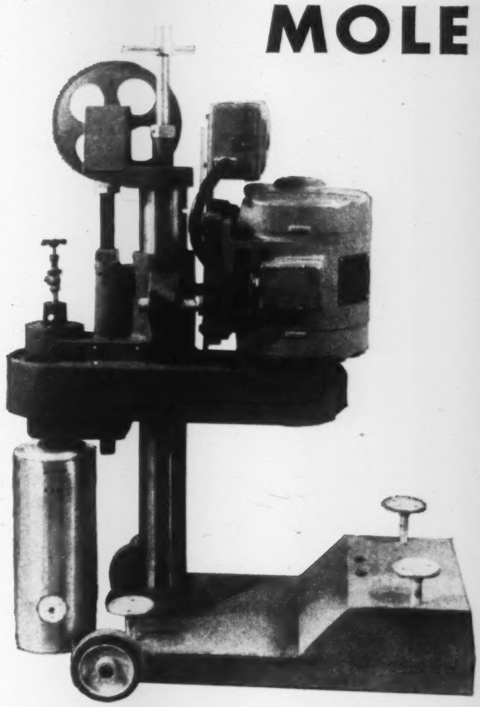
▶ *HARRISBURG STEEL CO., DIV. of HARSCO CORP.*—D. M. Horner, elected second vice president of *COMPRESSED GAS ASSOCIATION, INC.*

▶ *COBELL INDUSTRIES, INC.*—Sam B. Boyd, national sales manager.

▶ *BOHN ALUMINUM & BRASS CORP.*—S. D. Den Uyl, chairman of the board, elected chairman of the *ALUMINUM ASSOCIATION's* board of directors.

▶ *WESTERN ELECTRIC CO.*—William C. Wallin, chief of plant engineering department, elected national president of the *AMERICAN INSTITUTE OF PLANT ENGINEERS;* Sloan S. Sherrill, presented with Fellowship Award by *AMERICAN INSTITUTE OF PLANT ENGINEERS* for distinction in engineering profession.

POWER + SPEED
WITH THE
Model II MOLE



Drills through hard reinforced concrete where production jobs make you money. The extra power gives longer bit life.

3 H.P. Single Phase 110/220V. Electric Motor Max. Hole Size 6"
5 H.P. 3 Phase 220/440V. Electric Motor Max. Hole Size 8"

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WHO'S WHAT

Continued

▶ *CARLON PRODUCTS CORP.*—Rudolph Kustra, assistant to the vice president in charge of production; Hans Heilbronner, plant manager of the extrusion, molding and fabricating sections in Aurora, Ohio.

▶ *INSTITUTE OF BOILER AND RADIATOR MFRS.*—John I. Woodworth, administrative assistant to the general manager.

IN THE TERRITORIES . . .

(Recent sales appointments)

▶ *ILG ELECTRIC VENTILATING CO.*—R. B. Gage, Reading, Pa., sales representative.

▶ *SUMO PUMPS, INC.*—Roger Barron, technical representative in the Pacific and mountain states areas.

▶ *AMERICAN-STANDARD, PLUMBING AND HEATING DIV.*—James P. Driscoll, Boston sales manager.

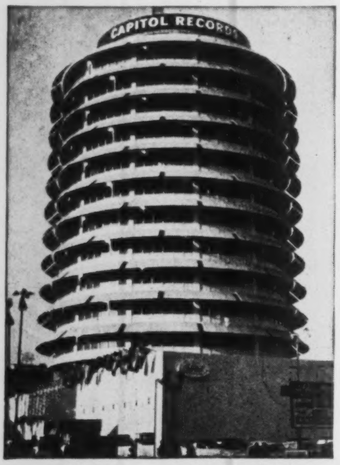
▶ *CARRIER CORP.*—Peirce-Phelps, Inc., Philadelphia, wholesale distributor.

▶ *CHASE BRASS & COPPER CO.*—Wallace L. Brown, midwestern regional manager.

▶ *KEASBEY & MATTISON CO.*—John L. Prechek, district sales manager of San Francisco office.

▶ *EUTECTIC WELDING ALLOYS CORP.*—New field service managers and their supervisory areas: Theodore C. Schmidt, eastern Michigan; Richard E. Saylor, western Michigan and northern Ohio; Clifford E. Kersker, Virginia, North and South Carolina; William S. Wells, Georgia, Alabama, Florida and Tennessee; Melvin F. Holder, midwestern states; Robert O' Gar, Pacific Coast states.

▶ *ALLIS-CHALMERS MFG. CO.*—E. E. Strickland, manager of general products division sales for northeast region; Joseph Varacalli, supervisor of original equipment manufacture and distributor sales for New York district; R. H. Porterfield, manager of industrial sales in New York district; W. T. Farnsworth, manager of Hartford, Conn., district.



CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

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MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW. FACTORY MUTUAL LABORATORIES APPROVED.

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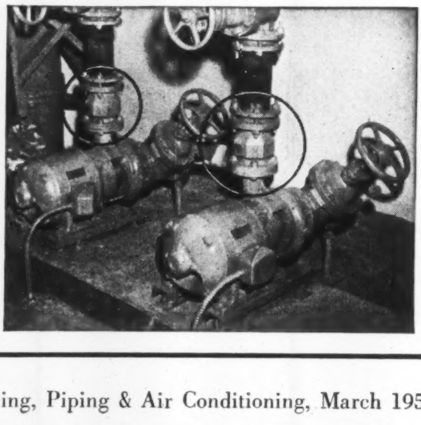

ALL STANDARD D-H "PERMA-FAN"

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ARE HOT-DIP GALVANIZED

"PERMA-FAN"

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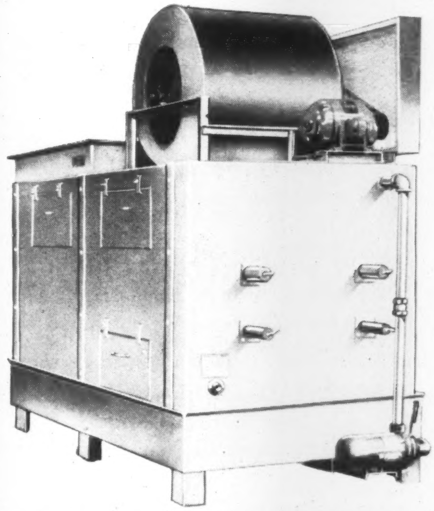

A D-H EXCLUSIVE! FOR FREON 12; FREON 22; AMMONIA. THE D-H PIONEERED BLOW-THRU PRINCIPLE... NOT DRAW-THRU! PRIMARY COIL SURFACE COPPER TUBING. VOLUME DAMPER ADJUSTMENTS. PRICE? WAY DOWN, ON BEDROCK! 12 MORE FEATURES SHOWN IN OUR "PERMA-FAN" BULLETIN. MAY WE SEND YOU A COPY? WRITE:

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non-clog design
high efficiency
up to 800 gpm
up to 60' heads

3 types:
Vertical Wet Pit
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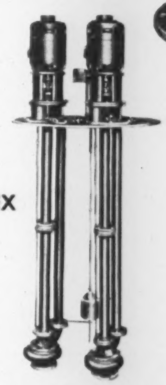
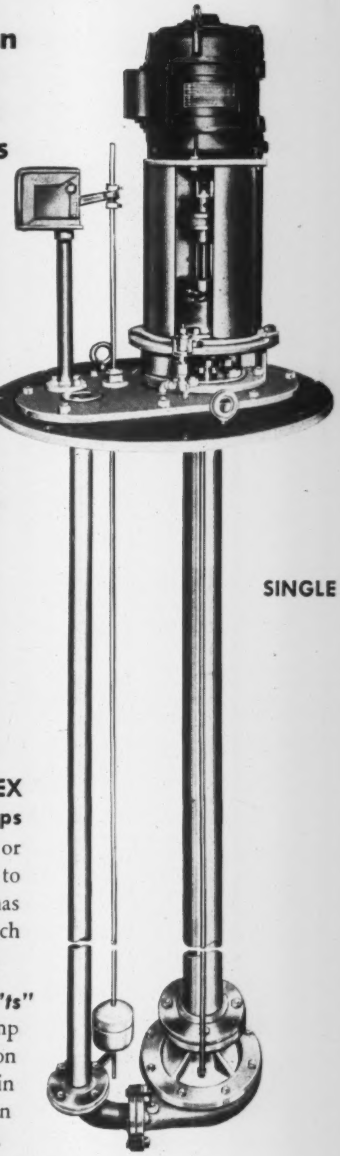


DUPLEX



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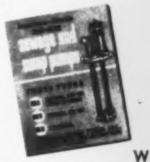
SINGLE and DUPLEX
Vertical Wet Pit Pumps

Handle clear liquids or liquids with solids up to 3" diameter. Duplex has mechanical float switch alternator (optional).

Helpful "Do's and Don'ts"



of pump selection given in Bulletin 325-A.

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AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN

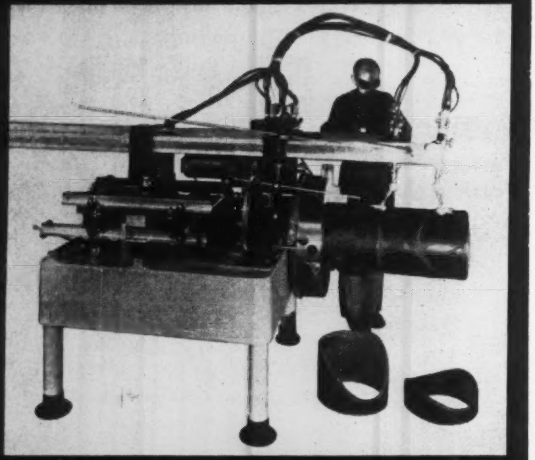
Pumps and Pumps only Since 1873

Representatives in all principal cities. See our ads in C.E.C., ASME Catalogs

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, ETC.

NOW CONTOUR PIPE WITHOUT CAMS OR TEMPLATES

..with "THE MECHANICAL DRAFTSMAN"



Model 424 shown making 30° contour cut and straight cut-off simultaneously on 16" pipe.

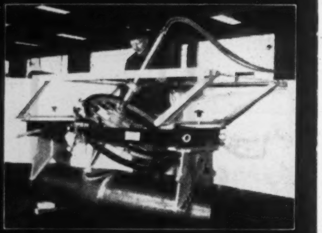
Available in 3 models for various pipe sizes.

May be equipped with Heliare for cutting of Aluminum, Stainless, Copper, etc.

"The MECHANICAL DRAFTSMAN" makes accurate, slag-free cuts . . . *ready for welding . . . automatically.*

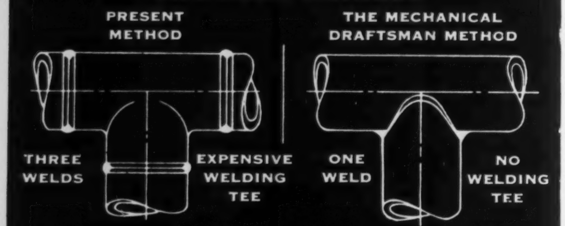
"THE MECHANICAL HOLE CUTTER"

Cuts a perfect hole to match the contoured end cut made by The MECHANICAL DRAFTSMAN. Will cut circles and ellipses in flat plate, as well as perpendicular or angular holes in pipe and tank shells. Available in 3 Models to cut holes to 24" diameter.



Model 024-Mechanical Hole Cutter

PIPE JOINT METHODS



Specify "The MECHANICAL DRAFTSMAN" machine cut joints. Elimination of welding fittings and reduction in cutting, fitting and welding time in piping installations results in material and labor savings as high as 75%.

STEFFAN MANUFACTURING CORP.
SALEM, OHIO

WHO'S WHAT

Continued

▶ *TYPHOON AIR CONDITIONING CO.* and *TYPHOON HEAT PUMP CO.*—Air Conditioning Equipment Distributors, Inc., Tampa, Fla., distributors for the Florida West Coast area.

▶ *MINE SAFETY APPLIANCES CO.*—Earl J. Finear, sales engineer for technical products division in Baton Rouge, La., territory.

▶ *NATIONAL SUPPLY CO.*—David A. Hess, New York district manager for tubular division.

▶ *KENISCO TUBE CO.*—Alex F. Campbell, industrial sales representative in New England area.

▶ *BRISTOL CO.*—Harry E. Beane, Jr., sales engineer in Albany-Syracuse area.

▶ *FARR CO.*—James R. Mason, representative in Allegany and Garret counties, Maryland, and Clarke and Frederick counties, Virginia.

▶ *WOLVERINE TUBE, DIV. of CALUMET & HECLA, INC.*—Charles M. Rhodes, sales representative in Birmingham, Ala., district.

▶ *PHELPS DODGE COPPER PRODUCTS CORP.*—K. F. Packard, district manager of new office in Denver to serve Colorado, Wyoming and New Mexico.

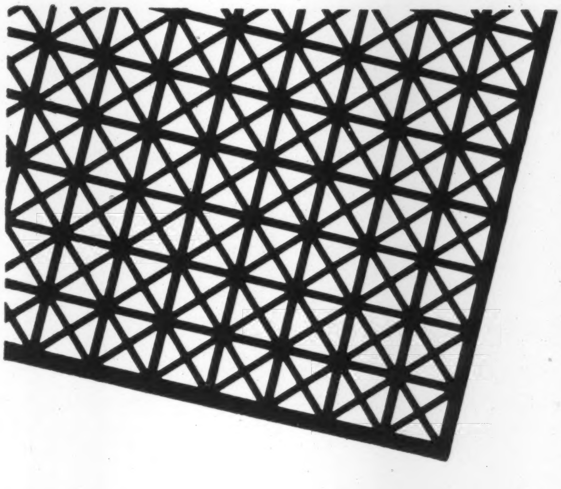
▶ *RUBEROID CO.*—Charles L. Haugh, sales manager of St. Louis sales district; George J. Garthwaite, assistant sales manager of New York district.

▶ *AMERICAN AIR FILTER CO., INC.*—Machinery & Equipment Sales, Inc., Baltimore, representative.

▶ *A. M. BYERS CO.*—Robert D. James, field service engineer in Houston division office; Colonial Supply Co., Pittsburgh, distributor.

▶ *B-I-F INDUSTRIES, INC.*—John Z. Buckley, sales engineer in Buffalo, N. Y., office.

▶ *EASTMAN CHEMICAL PRODUCTS, INC.*—John Marvin, manager of plastic division sales office in Greensboro, N. C., serving area including Virginia, North Carolina and parts of South Carolina, Tennessee and Kentucky.



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When an architect draws up specifications for a new building or a modernization proposal he must adhere to two basic principles: FIRST, he must use his head in keeping costs down. SECOND, he must recommend functional materials and components that appeal to his client's decorative motif and sense of beauty. That's why more and more architects specify Hendrick Grilles. Available in hundreds of attractive designs, Hendrick Grilles cost less to buy . . . cost less to install and cost less to maintain! And they provide more-than-ample area for free passage of air . . . always lie flat . . . don't bend or warp. For more information write to Hendrick, today.

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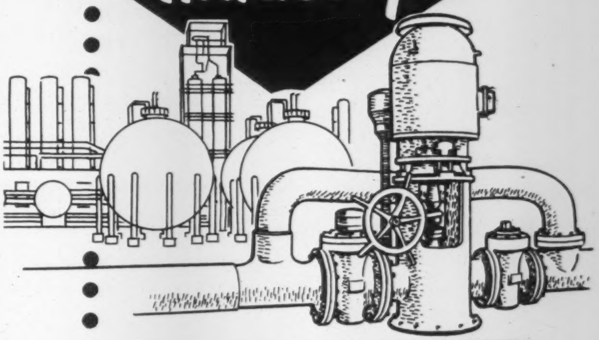

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VERTICAL TURBINE PUMPS

Tough pumping jobs demand the rugged dependability that FloWay pumps have so ably demonstrated. Two generations of pump experience back up the specialized designs—the selection of fine materials—the precision manufacturing—and the rigid inspection that assures peak performance under the most exacting conditions. Inquire today about FloWay.

DESIGNED FOR EVERY NEED

FloWay capacities range from 15 GPM to 4000 GPM. Equipped with either standard cast iron or fabricated steel heads, as required. Component parts are of materials and type to fulfill the specific pumping need effectively. See your dealer or write for detailed information.

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FIESE & FIRSTENBERGER MFG., Inc.
2494 Railroad Ave. Fresno, Calif.

WHO'S WHAT

Continued

▶ *CHICAGO NIPPLE MFG. CO.*—Jack Ross, New England salesman.

▶ *SOLAR AIRCRAFT CO.*—New representatives include: Energy Control Corp., Philadelphia; Energy Control Co., Inc., New York; Deco Engineering Products, Des Moines; Mechanical Equipment Co., Charlotte, N. C.

▶ *SUMO PUMPS, INC.*—Thomas Parsons, factory representative in Georgia, Alabama, northern Florida.

▶ *CLEVELAND HEATER CO.*—Fred Stevenson, Sr., sales representative for North and South Carolina, Georgia, Tennessee, Alabama, northern Mississippi; Ralph Simmons Co., Kenmore, N. Y. representative in Buffalo area.

▶ *LAU BLOWER CO.*—W. J. Lohrey, midwest district manager reappointed to Iowa and Nebraska; C. L. Sigman has moved his headquarters from Kansas City to Dallas with no change in his territory

▶ *WOLVERINE TUBE, DIV. of CALUMET & HECLA, INC.*—J. M. Jacobs, sales representative in St. Louis area with headquarters at 25 S. Bemiston Ave., Clayton, Mo.

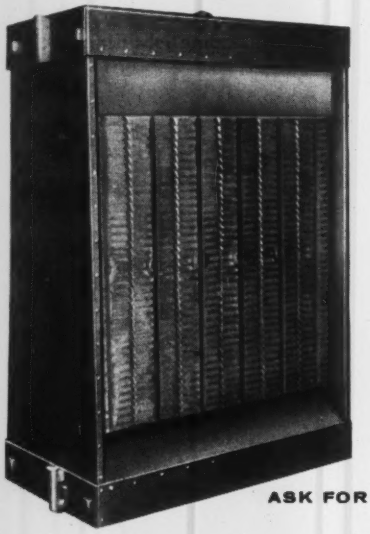
▶ *BOHN ALUMINUM & BRASS CORP.*—Philip T. Miner, sales agent for Texas, Louisiana, Oklahoma; Carl Olin, sales representative for California, Arizona, Nevada.

▶ *GENERAL CONTROLS CO.*—Robert M. Johnson, western regional manager.

▶ *WHITE-RODGERS CO.*—Two new west coast sales and service branches: 2846-52 N. E. Glisan St., Portland; 201 Glendale Blvd., Los Angeles 26.

▶ *WHEATLAND TUBE CO.*—New sales representatives: Alexander Hays, III, western Pennsylvania, Ohio, West Virginia; Richard M. Scott, Michigan; Mike Sommer and Robert Cerwin, New York area.

▶ *GENERAL FITTINGS CO.*—Wellisch-Magratten Associates, Jackson Heights, N. Y., agents in western and upper New York.



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UNIT HEATERS

GUARANTEED TO REDUCE MAINTENANCE COSTS!

Provides large volume of air over wide floor area, continuously, economically. Sturdy enclosure houses the patented Wilson all-cast aluminum radiation element with integrally cast directional fins. Completely eliminates the need for costly, troublesome louvers. Recognized as a unit heater that is completely dependable in service where corrosive atmospheres are encountered. ***Capacities 64,000 to 430,000 BTU.***

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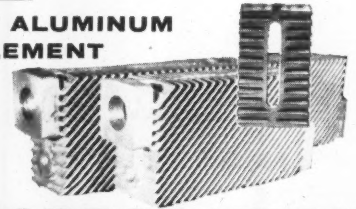
- HIGH THERMAL EFFICIENCY
- EXTREMELY RUGGED
- COMPACT DESIGN

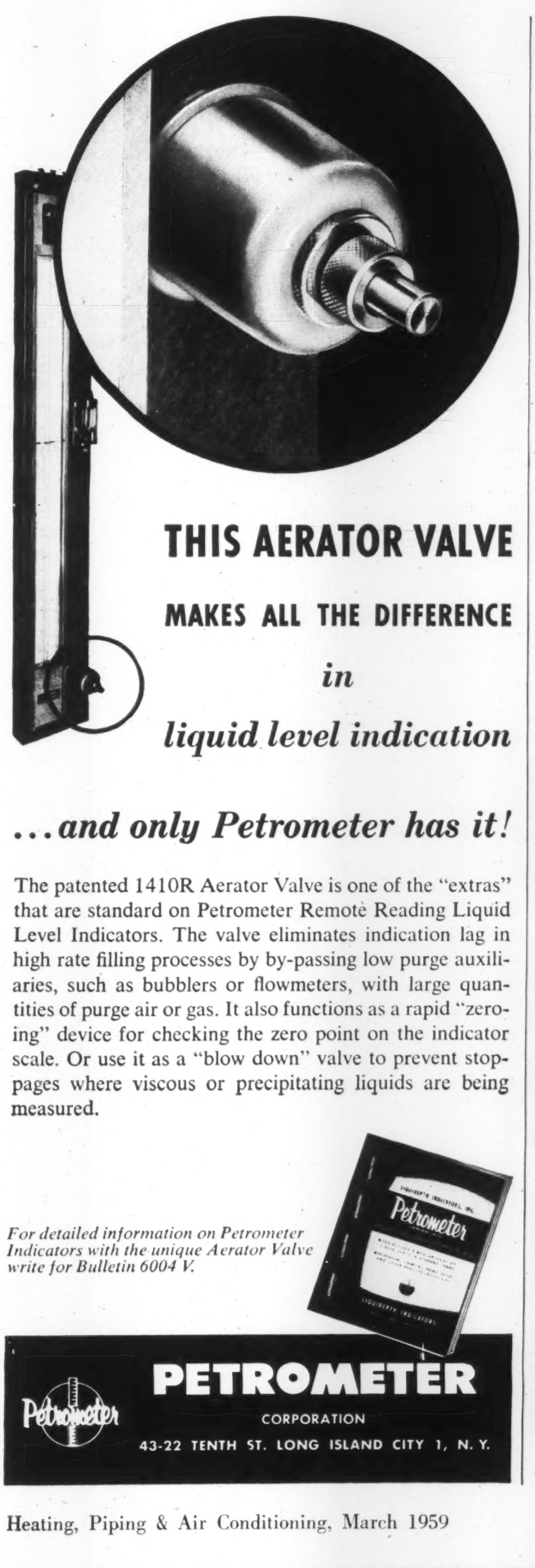
WILSON ALL-CAST ALUMINUM RADIATION ELEMENT

This is the same proved radiation element used so successfully in severe diesel locomotive service. Chamber shape plus the patented 45° directional fin feature provides high thermal efficiency in a compact design. Extremely rugged in construction. High pressure hydrostatic tested.



WILSON ENGINEERING CORPORATION

6 NORTH MICHIGAN AVENUE CHICAGO 2, ILLINOIS DEPT. J-3



THIS AERATOR VALVE

MAKES ALL THE DIFFERENCE

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liquid level indication

...and only Petrometer has it!

The patented 1410R Aerator Valve is one of the "extras" that are standard on Petrometer Remote Reading Liquid Level Indicators. The valve eliminates indication lag in high rate filling processes by by-passing low purge auxiliaries, such as bubblers or flowmeters, with large quantities of purge air or gas. It also functions as a rapid "zeroing" device for checking the zero point on the indicator scale. Or use it as a "blow down" valve to prevent stoppages where viscous or precipitating liquids are being measured.

For detailed information on Petrometer Indicators with the unique Aerator Valve write for Bulletin 6004 V.

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CORPORATION
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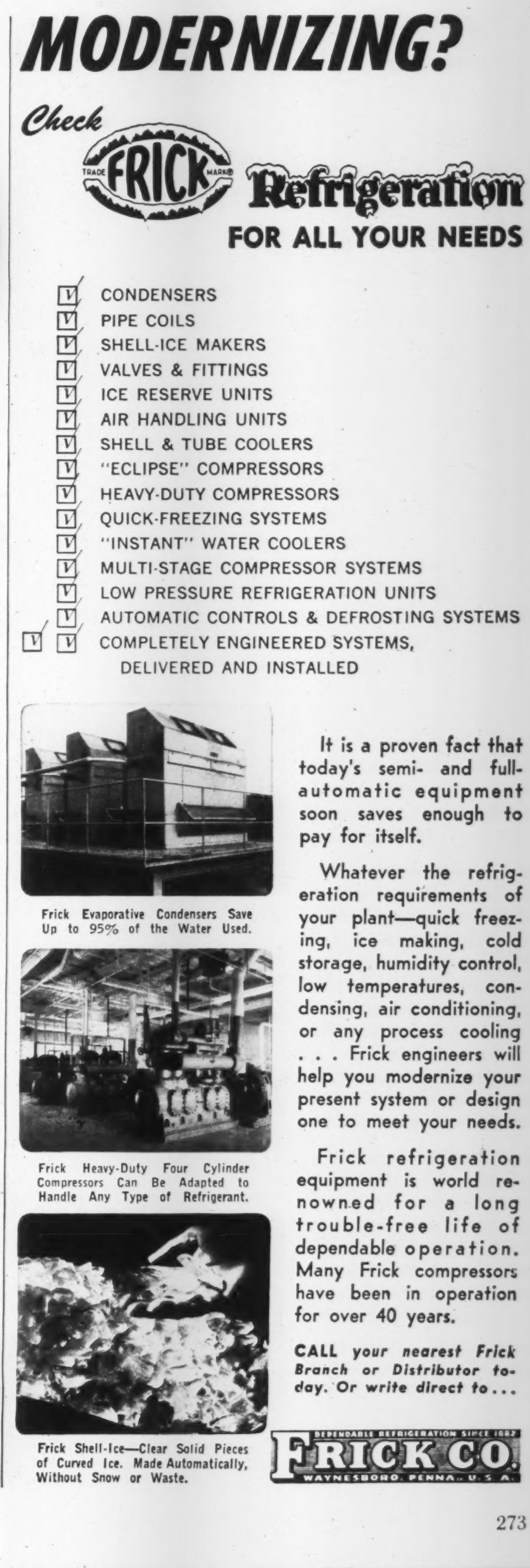

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Check FRICK Refrigeration

FOR ALL YOUR NEEDS

- ☑ CONDENSERS
- ☑ PIPE COILS
- ☑ SHELL-ICE MAKERS
- ☑ VALVES & FITTINGS
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- ☑ AUTOMATIC CONTROLS & DEFROSTING SYSTEMS
- ☑ ☑ COMPLETELY ENGINEERED SYSTEMS, DELIVERED AND INSTALLED

Frick Evaporative Condensers Save Up to 95% of the Water Used.

Frick Heavy-Duty Four Cylinder Compressors Can Be Adapted to Handle Any Type of Refrigerant.

Frick Shell-Ice—Clear Solid Pieces of Curved Ice. Made Automatically, Without Snow or Waste.

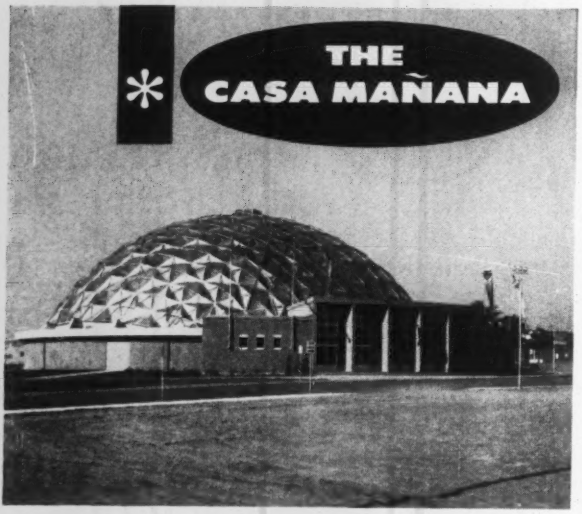
It is a proven fact that today's semi- and full-automatic equipment soon saves enough to pay for itself.

Whatever the refrigeration requirements of your plant—quick freezing, ice making, cold storage, humidity control, low temperatures, condensing, air conditioning, or any process cooling . . . Frick engineers will help you modernize your present system or design one to meet your needs.

Frick refrigeration equipment is world renowned for a long trouble-free life of dependable operation. Many Frick compressors have been in operation for over 40 years.

***CALL** your nearest Frick Branch or Distributor today. Or write direct to . . .*

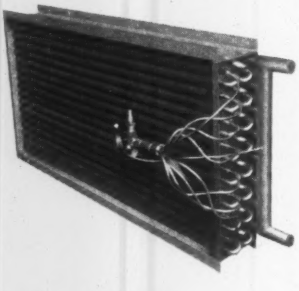
DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA., U. S. A.



. . . another outstanding application of THERMAL Cooling and Heating Coils

Specifications for the cooling and heating coils in the main air conditioning system of the new ultra-modern *House of Tomorrow Musical Theater in Fort Worth called for not only top quality but **fast** delivery. Thermal Engineering delivered both.

Thermal Engineering Corporation of Houston manufactures central plant air conditioners, multi-zone air conditioners, cooling and heating coils, sprayed coil units, heating and ventilating units and air cooled condensers—all famous for long life, efficient operation and prompt delivery. When you want **tomorrow's** air conditioning and ventilating equipment today—specify Thermal.



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Agents in principal cities.

Quality Products Since 1945

THERMAL ENGINEERING CORPORATION

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HOUSTON 19, TEXAS

WHO'S WHAT

Continued

▶ *MINE SAFETY APPLIANCES CO.*—William J. Young, sales engineer for Houston territory.

▶ *DRAYER-HANSON, DIV. of NATIONAL-U. S. RADIATOR CORP.*—McDougall Sales Co., New Orleans, exclusive sales agent in Louisiana.

▶ *NATIONAL CYLINDER GAS DIV. of CHEMETRON CORP.*—New north central region offices at 2191 S. Green Rd., Cleveland; new sales office and warehouse established at 2045 Meeting St., Charleston Heights, S. C.

▶ *FLEXAUST CO., DIV. of CALLAHAN MINING CORP.*—T. G. May, eastern sales manager, now responsible for advertising and sales promotion; R. P. Carrington, central regional sales manager with offices in New York; S. J. Stanfield, western regional sales manager with offices in Chicago.

▶ *H. K. PORTER CO., INC.*—James S. Miller, southwest district manager for Forge and Fittings Div.

▶ *JOSEPH T. RYERSON & SON, INC.*—Freeman X. Kinzie, stainless steel district sales manager in Los Angeles; Loren B. Clay, tubing and cold finished steel bars district sales manager in Los Angeles; Harry M. Cassel, alloy steel district sales manager in Los Angeles.

▶ *REMINGTON CORP.*—E. Moise Johnson, southern sales manager, elected vice president of company.

▶ *AMERICAN WATER SOFTENER CO., INC.*—Kissick Co., New York, representative in southern New York, western Connecticut and northern New Jersey.

▶ *TACO HEATERS, INC.*—Robert H. Stevenson, representative in southeastern Massachusetts and Rhode Island; Emmett Pollenz, New York district sales manager.

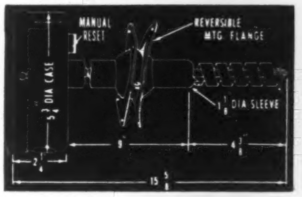
▶ *VAN-PACKER CO., DIV. of FLINTKOTE CO.*—C. M. Montgomery, sales manager of new eastern district; W. C. Henson, sales manager of new western district.

▶ *E. I. DU PONT DE NEMOURS & CO.*—Virginia Smelting Co., Norfolk, Va., nationwide sales agents for refrigerants. +

MERCOID®

HIGH TEMPERATURE LIMIT CONTROL

FOR OVENS, DRYERS, FURNACES



FM

APPROVED

Type MX-51R

Semi-Automatic with Hand Reset

Mercoid Type MX-51R is an adjustable indicating type high temperature limit control actuated by a coiled bimetal element to result in a normally closed mercury (tube type) switch opening in event the supervised temperature reaches the preset limit point. An externally operated manual reset knob is arranged to reset the mercury switch after high temperature operation and normal temperature restoration.

The prevailing temperature and limit settings may be observed on the calibrated dial thru the glass fronted cover.

SPECIFICATIONS

Type MX-51R: SP-ST circuit opens automatically at the preset control setting on temperature rise. Manual reset provided to restore switch to closed position after temperature falls.

(Available SP-ST—circuit to close automatically at the preset control setting on temperature drop. Manual reset restores switch to open position on temperature rise.)

OPERATING RANGE

Adjustable: 50 to 650°F.
Minimum Differential: 20°F.

ELECTRICAL RATING

a-c or d-c: 10A. 115V., 5A. 230V.
Available on order 3A. 440V.
Electrical connection: ½" opening for conduit or BX.

WRITE FOR BULLETIN
SEB-51

THE MERCOID CORPORATION
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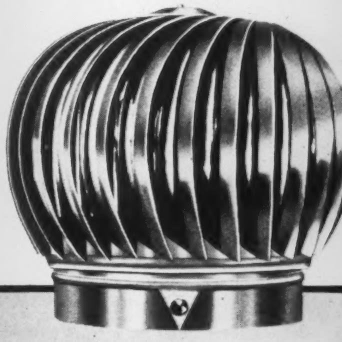
Nothing but the best...



WESTERN ROTARY ROOF VENTILATORS with Lifetime Guaranteed BEARINGS

1. "Backward curved blower wheel" type mechanism assures high, constant exhaust capacity.
2. No backdraft, ever.
3. Unique factory lubricated sealed bearings are specially designed for positioning load, countering wind pressure, assuring stability.
4. Locked-on rotor, yet removable without special tools.
5. Exclusive Western corrugated vane increases rigidity.
6. Low, functional type adds beauty.
7. Aluminum, copper, or stainless steel construction available.
8. Baked enamel paint coating for beauty and long life.

Other type ventilators include:

- Stationary
- Directional
- Continuous ridge
- Vertical exhaust
- Axial roof
- Unit ventilators

Write for catalog and name of nearest representative.

WESTERN ENGINEERING AND MFG. CO.
4108 Glencoe Avenue, Venice, California

WE HEAR THAT . . .

▶ *BAYLEY BLOWER CO.* has been acquired by *GREEN FUEL ECONOMIZER CO., INC.* The two companies will produce a wide range of air-moving equipment.

▶ *SNYDER, PALMER, TOUSSAINT AND ASSOCIATES, INC.* is the new name of a Minneapolis consulting engineering firm offering mechanical and electrical engineering services. The firm occupies offices at 1645 Hennepin Ave., Minneapolis.

▶ *EASTMAN CHEMICAL PRODUCTS, INC.'s* new "910" adhesive is now available in commercial quantities from *ARMSTRONG CORK CO.* The company was chosen as a co-marketer, because of its long experience in the field and its ability to provide technical assistance and laboratory service.

▶ A two-fold expansion program, providing for more economical mass production and additional space for new product development has been achieved by *UNITED STATES GAUGE, DIV. of AMERICAN MACHINE AND METALS, INC.* in a new plant recently completed on the company's property at Sellersville, Pa. Manufacturing and shop office area are provided with 180,000 sq ft of floor space.

▶ *OLIN MATHIESON CHEMICAL CORP.* has sold its majority interest in *HUNTER ENGINEERING CO.* to *JOSEPH L. HUNTER,* who is now sole owner of the company. He will continue to operate it for the manufacture of aluminum sheet, strip and extrusions.

▶ The management of the *CRANE CO.* will submit 11 nominees for the board of directors to the company's stockholders. The shareholders meeting will be held in Chicago on April 28.

▶ *AMERICAN BLOWER* and *KEWANEE BOILER* have been consolidated with *ROSS HEAT EXCHANGER DIV.* to form the new *INDUSTRIAL DIV. of AMERICAN-STANDARD.* The new division will continue to manufacture and market the same products made by the three former divisions.

▶ *ASSOCIATED VALVE CO.* is coördinating its manufacturing and marketing facilities with *MARINE & INDUSTRIAL PRODUCTS CO.* The two firms have been relocated at a 30,000 sq ft plant and office building in North Wales, Pa., near Philadelphia.

▶ In keeping with its plans for increased activity in the aluminum market, *ANACONDA CO.* has merged two of its wholly-owned subsidiaries, *AMERICAN ALUMINUM CO.* and *COCHRAN FOIL CORP.* into an-

Air Controlled
WILL-BURT
STOKER

Coal has always been dependable **now it can be automatic**

Will - Burt Hopper and Bin Feed Model Stokers — capacities, 150 through 750 lbs. per hr.

A Will-Burt coal heat installation will *bring coal from bin to stoker . . . feed the necessary coal at any of three adjustable rates . . . and automatically adjust air supply minute by minute, to fuel bed needs.* Panel controls by Will-Burt will *automatically cycle one stoker, or several.*

What could be more practical — especially when you consider the known economy and safety of coal fired heat?

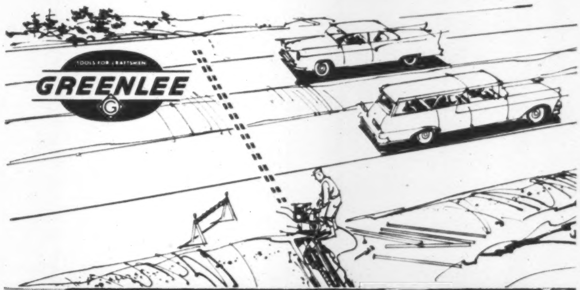
W-B Automatic Air Control — sensitively controls air supply — prevents excessive soot or smoke.

W-B Coal Conveyor — practical for any installation — operates at any angle — single, dual, or cross feed tandem.

W-B Panel Controls — make scheduled heating a simplified, supervisory operation — tailored to the job.

WILL-BURT
STOKERS
Box 902 ORRVILLE, OHIO

EASY, Low-Cost Way to Run Pipe Under Streets, Walks, Floors



Greenlee Hydraulic Pipe Pusher
Hand- or Power-Operated

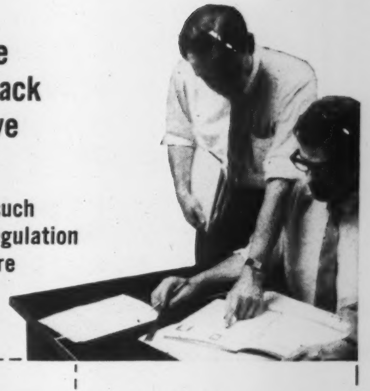
Traffic proceeds as usual when your piping crosses under streets or sidewalks this simple, timesaving way. Model No. 790 shown pushes $\frac{3}{4}''$ - $4''$ pipe about two feet per minute with power pump. A small ditch in the parkway accommodates the pusher — streets and walks remain undisturbed. Costly tearing up, tunneling, filling, repaving are eliminated . . . total job time and cost are cut to a fraction. The same efficiencies and savings apply on under-floor installations or on pipe-pulling jobs. That's why the Greenlee Pipe Pusher often pays for itself the first few times used. See your supplier for a demonstration or write for descriptive literature.

GREENLEE LINE OF TIMESAVING TOOLS FOR PIPE FITTERS AND PLUMBERS ALSO INCLUDES PIPE BENDERS, PIPE BITS, POWER BITS

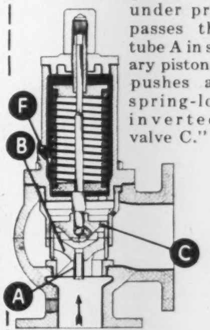
GREENLEE TOOL CO. GREENLEE
1770 Columbia Ave., Rockford, Illinois

"How does the Klipfel #135 back pressure valve work?"

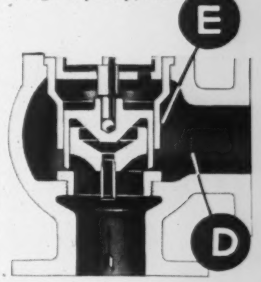
How can it give such close pressure regulation (4% over the entire capacity range)? Here's the story:



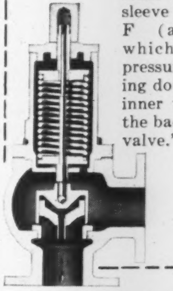
"Controlling inlet pressure and flow in a pipe line is all any back pressure valve does. How *well* it does this is, however, a different story. In this Klipfel Valve liquid under pressure passes through tube A in stationary piston B, and pushes against spring-loaded, inverted-cup valve C."



"When liquid pressure exceeds spring pressure, valve lifts open, letting liquid flow into outlet chamber D. This shows how Klipfel No. 135 Valves give such close regulation; why they have such high capacity, too.



"This is the same back pressure valve, modified to act as a relief valve. As you might guess, relief valves prevent excess pipe line pressures by relieving to the atmosphere. The only difference between the two valves is that the relief valve has no sleeve E and vent F (above)—which prevent pressure from acting downward on inner valve C in the back pressure valve."



"Most important feature in any back pressure or relief valve (aside from dependability) is smooth, chatter-free opening and closing. Also, relief valves should close tightly, but this isn't so important in back pressure valves."

• For the complete story of back pressure and relief valves, without cost or obligation, write for Bulletin 454.

HAMILTON • OHIO **Klipfel** **VALVES INC.**

Automatic Temperature-and-Pressure-Regulating Valves Since 1902

Float Valves • Temperature Regulators • Back Pressure Valves • Reducing Valves

A DIVISION OF THE HAMILTON-THOMAS CORPORATION

Available NOW!

INDUSTRIAL VENTILATION MANUAL

5th OFFICIAL EDITION

- ✱ Revised equation for oven ventilation.
- ✱ New material on ventilation of radioactive and high-toxicity contaminants.
- ✱ 16 new hood designs, 33 revised hood designs.
- ✱ New material on air cleaning for radioactive contaminants.
- ✱ Revised equation for airflow into hoods.
- ✱ Revised table for collectors in industry.
- ✱ New chart on comparison of air filter characteristics.
- ✱ Revised, up-to-date table of maximum allowable concentrations.
- ✱ Revised table of physical constants.

Here's the biggest and most comprehensive Industrial Ventilation Manual yet — over 200 pages, containing more than 200 diagrams, 52 tables of ventilation material and 13 ventilation charts.

The Ventilation Manual contains all the information needed for the complete design of industrial ventilation systems. It is the official publication of the American Conference of Governmental Industrial Hygienists and is used as a basic text by leading universities. The recommended ventilation practices are approved by Federal, State and Municipal Government Industrial Hygiene Departments.

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WE HEAR THAT

(Continued)

other, *ANACONDA ALUMINUM CO.* The executive offices for the merged subsidiary will be located at Louisville, Ky.

▶ *MASTER-CRAFT SUPPLY CO., INC.* is changing its name to *MASTER-CRAFT INDUSTRIES, INC.* in order to reflect its diverse manufacturing activities.

▶ *AUTOMATIC CONTROL CO.* has formed a new subsidiary, *AUTOCON INDUSTRIES, INC.*, to handle its sales program. The new branch will deal directly with manufacturers' representatives in more than 40 cities.

▶ After nearly 48 years of continuous service with *YORK CORP., Subs. of BORG-WARNER CORP.*, and its predecessors, *STEWART E. LAUER* has announced his retirement as chairman of the board and chairman of the supervisory board.

▶ Formal ceremonies dedicating the new product research and development laboratory of *VULCAN RADIATOR CO.* at Hartford, Conn., were held recently. A formal dinner followed the dedication ceremonies.

▶ The "Tenite" plastics development laboratory of *TENNESSEE EASTMAN CO.*, manufacturing division of *EASTMAN KODAK CO.*, has been enlarged by approximately 5000 sq ft in order to accommodate additional equipment and personnel.

▶ Researchers are now moving into *HOOKER CHEMICAL CORP.*'s new research center at the north end of Grand Island, N. Y. The 69,000 sq ft building is located on a 61 acre site.

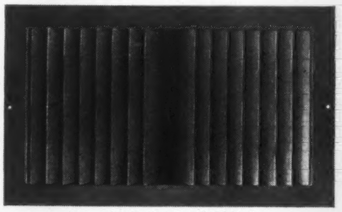
▶ *ADHESIVE TAPE CORP.* has announced the acquisition of a modern pressure sensitive adhesive tape manufacturing plant at 58 Seabring St., Brooklyn 31.

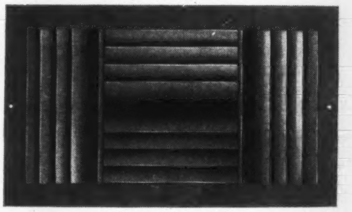
▶ *CARRIER CORP.* announced that $20,000 in educational awards will be given this year to call attention to its 1959 line of room air conditioners.

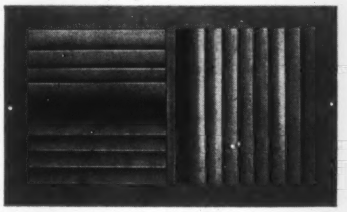
▶ *MANNING, MAXWELL & MOORE, INC.* recently announced the relocation of its nuclear and electronic process control product lines. Space in the company's Watertown, Mass., plant will be utilized by the nuclear products department. Manufacture of electronic process control instruments will be moved to the Stratford, Conn., plant.

▶ *AIR HEATERS, INC.* was recently formed in Youngstown, Ohio, with *ARTHUR A. OLSON*, president, *T. F. SCHILLING*, treasurer, *JOHN WEHMHOFF*, secretary, and *LEE WILSON*, member of the board.

NEW FROM A-J!


A-J 200 AIF


A-J 200 CF


A-J 200 BF

No. 200 SERIES CEILING DIFFUSERS

with 18 different deflection patterns!

Have a special air distribution problem? Solve it quickly, easily, economically with an A-J No. 200 Series Ceiling Diffuser.

Extruded aluminum curved blades provide maximum air control with minimum resistance. Face bars are 1¼" wide on ¾" centers. You can have your choice of multiple valves (No. 230) or opposed blade dampers (No. 240). Available in either sturdy steel or extruded aluminum frames. Platinum enamel is standard finish.

Write for FREE copy of our catalog.

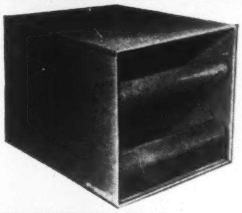
A-J Manufacturing Co.

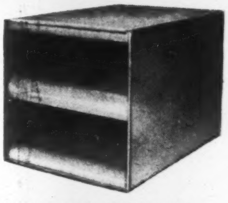
Dept. H-3 3601 East 18 Street Kansas City 27, Missouri

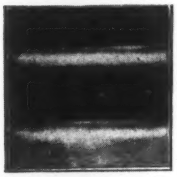
UNI-SILENCER* For AIR CONDITIONING and VENTILATING SYSTEMS

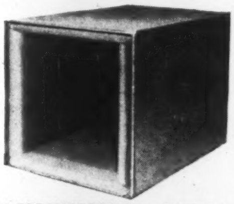
A full line of Elof Hansson silencers to effectively reduce air-borne noise generated by fans in air conditioning, ventilating systems and by power roof ventilators. They are easily and conveniently installed in building structures at low cost due to new mass-production methods made possible by standardizing on modular sizes. Savings are of such proportions that UNI-SILENCER* prices compare favorably with conventional duct lining.

The performance of UNI-SILENCERS,* both as to acoustical attenuation and pressure loss have been tested and certified by independent, impartial outstanding authority. The certified data is guaranteed in writing and bonded. Free engineering service! Fill out and mail coupon for literature today!

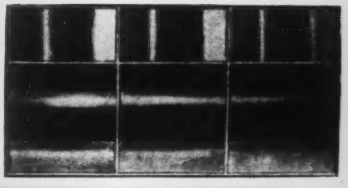

UNI-SILENCER* MODEL A
Moderate pressure drop, standard acoustical efficiency

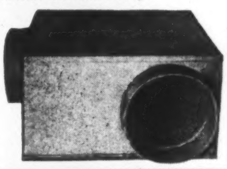

UNI-SILENCER* MODEL LPD
Lowest possible pressure drop, moderate acoustical efficiency


UNI-SILENCER* MODEL B
Higher pressure drop, maximum acoustical efficiency


UNI-RESONATOR* Low frequency duct silencer—used in series with UNI-SILENCERS*

UNI-SILENCERS* are slip-joined in simple manner as with children's building blocks, to fit almost any conditions or requirements.




T. O. SILENCER
Elbow silencer for ducts

E H ROOF VENTILATOR SILENCER for power roof ventilators

*Reg. U.S. Pat. Off.

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Please send complete literature on performance-guaranteed Uni-Silencers and Uni-Resonators, without charge or obligation.

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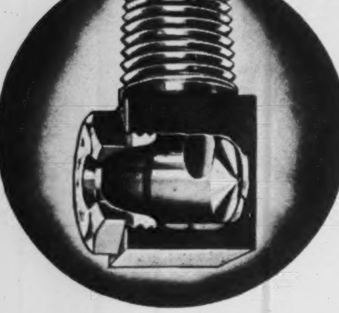

Monarch

NOZZLES
for
AIR WASHERS

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.
Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 5/8" square stock.

Write for Catalog I

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2523 E. ONTARIO ST.
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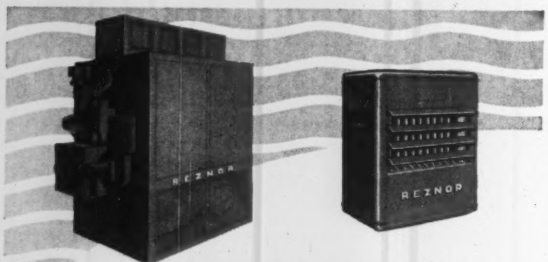


economy

BTU for BTU, Reznor gas unit heaters cost much less than most other types of heating equipment. Installation offers additional savings . . . it requires only suspension, gas and electrical connections, and simple venting. And Reznor suspended units help you hold down total cost per usable square foot . . . because they occupy absolutely no valuable floor space.

ECONOMY makes these completely-automatic packaged units the ideal way to heat a wide variety of commercial and industrial buildings. Ask your Reznor distributor for the complete story or write for your free copy of "Modern Heating"

Look for Reznor under "Heaters-Unit" in the Yellow Pages

REZNOR
WORLD'S LARGEST-SELLING DIRECT-FIRED
UNIT HEATERS

Reznor Manufacturing Company, 51 Union Street, Mercer, Pa.

MEETINGS & CONVENTIONS

1959

MARCH 16-20—*National Association of Corrosion Engineers*, 1959 Corrosion Show and 15th annual conference. Sherman Hotel, Chicago. National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

MARCH 31-*APRIL* 2—*American Power Conference*, sponsored by Illinois Institute of Technology in cooperation with a group of technical societies and other educational institutions. Hotel Sherman, Chicago. Information: R. A. Budenholzer, Mechanical Engineering Dept., Illinois Institute of Technology, 3300 Federal St., Chicago 16.

APRIL 1-3—*Gas Appliance Manufacturers Association*, annual meeting. The Greenbrier, White Sulphur Springs, W. Va. GAMA headquarters: 60 E. 42nd St., New York 17.

APRIL 5-9—*Nuclear Congress.* Cleveland Auditorium, Cleveland. Information: Engineers Joint Council, 29 W. 39th St., New York 18.

APRIL 5-9—*Edison Electric Institute*, annual convention, New Orleans. Edison Electric Institute, 420 Lexington Ave., New York 17.

APRIL 6-8—*Building Research Institute*, 8th annual meeting. Penn Sheraton Hotel, Pittsburgh. Building Research Institute, National Academy of Sciences—National Research Council, 2101 Constitution Ave., Washington 25, D.C.

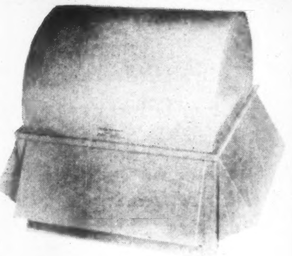
APRIL 6-10—*American Welding Society*, 40th annual meeting. Hotel Sherman, Chicago. American Welding Society, Inc., 33 W. 39th St., New York 18.

APRIL 6-10—*International Atomic Exposition*, sponsored by Atomic Industrial Forum, Inc., Cleveland. Information: H. F. Grebe, exhibits manager, International Atomic Exposition, Architects Bldg., Philadelphia 3.

APRIL 28-*MAY* 1—*Mechanical Contractors Association of America*, 70th annual convention. Shoreham Hotel, Washington, D. C. Mechanical Contractors Association of America, 45 Rockefeller Plaza, Suite 570, New York 20.

APRIL 29-*MAY* 4—*Oil-Heat Institute of America, Inc.*, annual convention. Seattle, Wash. Oil-Heat Institute of America, Inc., 500 Fifth Ave., New York 36.

GREENHECK *Air Movement Devices*

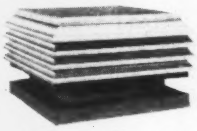


1959 "DALLAS" AIR MOVER
POWER ROOF EXHAUSTER

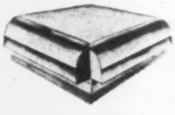
For the highest quality materials and workmanship at the lowest possible price, specify the GREENHECK "DALLAS" Air Mover. Features include rugged ball bearing motors completely isolated from the exhausted air stream, non-overloading backward curved wheels, vibration mountings, and highest quality sealed ball bearings for wheel shaft mounting. The hood is hinged for easy access to the motor and pulley belt area. Write today for catalog 10 which gives complete engineering information.

GREENHECK
FAN & VENTILATOR CORP.
SCHOFIELD • WISCONSIN

COLUMBUS
Direct Drive centrifugal power roof exhauster. 100 to 1400 CFM. Boston companion series belt drive 500 to 4300 CFM.

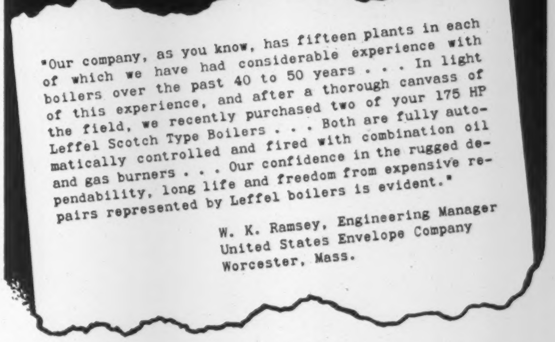


WAUSAU
Air Mover Belt drive centrifugal power roof exhauster. 300 CFM to 27,000 CFM range.



TUCSON
Air mover provides low silhouette centrifugal roof exhauster — capacity 200 to 20,000 CFM.

Why United States Envelope Co. Selected Leffel Scotch Boilers



"Our company, as you know, has fifteen plants in each of which we have had considerable experience with boilers over the past 40 to 50 years . . . In light of this experience, and after a thorough canvass of the field, we recently purchased two of your 175 HP Leffel Scotch Type Boilers . . . Both are fully automatically controlled and fired with combination oil and gas burners . . . Our confidence in the rugged dependability, long life and freedom from expensive repairs represented by Leffel boilers is evident."

W. K. Ramsey, Engineering Manager
United States Envelope Company
Worcester, Mass.

Mr. Ramsey knows boilers — and his decision to buy Leffel boilers is based on his company's broad experience. Don't be misled by the meaningless claims and promises so common in today's boiler advertising. U. S. Envelope's decision, after a thorough survey of the field, is real evidence of the superior construction and performance of Leffel boilers.

For complete details on Leffel boilers — gas, oil or coal-fired — for requirements from 6 to 500 HP, write today for your free copy of Bulletin 236. Compare Leffel construction with anything else on the market. The facts and figures will prove that you should buy Leffel . . . and that will be the beginning of safe, carefree, profitable boiler operation for you.

THE JAMES LEFFEL & COMPANY
Dept. H
SPRINGFIELD, OHIO

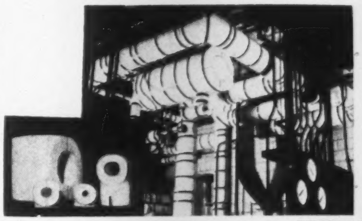
BEND BOTH PIPE AND COPPER WITH THIS SMOOTH-ACTING HYDRAULIC TAL BENDER!

Hein-Werner's Set Number 2-PH/CT TAL BENDER offers the right combination of equipment required to bend standard and X pipe up to 90° from 3/8 to 2 inches, XX pipe to 1½ inches; and 1 to 2 inch copper tubing up to 90°. It's complete and includes basic 2 inch TAL BENDER with standard hydraulic unit and "All Purpose" steel frame; seven short radius pipe bending shoes; four copper tube bending shoes, bars, clamps and connecting parts in sturdy wooden chest. Model MP-27 high speed TAL BENDER Motor Pump also available for faster bending.

The Hein-Werner line of portable hydraulic TAL BENDERS is complete. Models available for bending all types of material from 3/8 to 8 inches with standard shoes in 64 different radii and sizes. Send for detailed Catalog No. 35, or see your local plumbing and heating wholesaler.

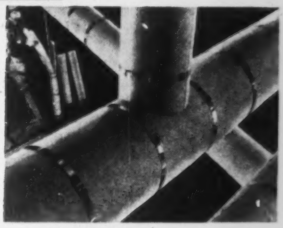
Hein-Werner CORPORATION
WAUKESHA, WISCONSIN

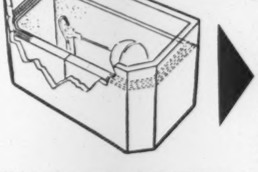
Glo-Brite . . . Your Fastest Source for STYROFOAM*



STYROFOAM* LOW TEMP.
Pipe and Vessel Insulation and Fitting Covers
Vapor Proof, Rot Proof, K Factor .23

STYROFOAM* ANTI-SWEAT
Pipe Covering
Saves 40% in Labor Cost! With Exclusive Adhesive Edges . . . factory applied!





STYROFOAM* JAYELITE
TOILET TANK LINER eliminates dripping tanks . . . fits inside any shape tank. Exclusive laminations bend around corners. Pre. cut for easy installation.

*A DOW Chemical Product

Write for spec sheets, data, installation information.

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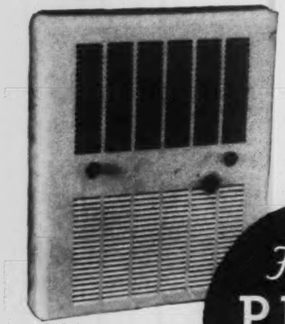
6415 North California Ave., Chicago 45, Illinois

ECONOMICAL HYDRONIC HEATING AND COOLING



Ideal For Commercial, Industrial and Institutional Applications

Famous **PENN** *Air-rads*

TWO SIZES
Heating—
10,000 and 22,000 BTU
Cooling—
5,000 and 10,000 BTU

Zoned heating and cooling from one easily installed fan-coil unit. True air conditioners, individually controlled. Fit between standard studs. Free standing models also available. See your distributor or write direct for literature.

Hydronic Heating-Cooling Pioneered By

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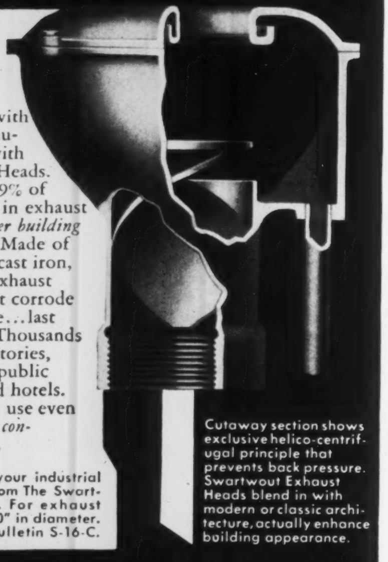
Swartwout
EXHAUST HEADS
slash building maintenance cost

Prevent the ravages of water and oil in exhaust steam during warm weather...do away with ice and grime accumulations in winter—with Swartwout Exhaust Heads. They remove over 99% of moisture and oil in exhaust steam—*for lower building maintenance.* Made of long-lasting cast iron, Swartwout Exhaust Heads do not corrode or deteriorate...last indefinitely. Thousands in use on factories, institutions, public buildings and hotels. Many still in use even after *50 years continuous service.*



Cutaway section shows exclusive helico-centrifugal principle that prevents back pressure. Swartwout Exhaust Heads blend in with modern or classic architecture, actually enhance building appearance.

Available from your industrial distributor or from The Swartwout Company. For exhaust pipes from 1 to 30" in diameter. Write for free Bulletin S-16-C.

The Swartwout Company
18511 EUCLID AVE. • CLEVELAND 12, OHIO

MEETINGS & CONVENTIONS

Continued

1959

MAY 25-29—*National Fire Protection Association,* annual meeting, Atlantic City, N. J. National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

JUNE 1-4—*National District Heating Association,* 50th golden anniversary meeting. Skytop Club, Skytop, Pa. Information: John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh 6.

JUNE 21-26—*American Society for Testing Materials,* annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. American Society for Testing Materials, 1916 Race St., Philadelphia 3.

JUNE 22-24—*American Society of Heating, Refrigerating & Air Conditioning Engineers,* annual meeting. Lake Placid Club, Lake Placid, N. Y., American Society of Heating, Refrigerating & Air Conditioning Engineers, 62 Worth St., New York 13.

JUNE 22-26—*Air Pollution Control Association,* annual meeting, with technical sessions and exhibits. Hotel Statler, Los Angeles. Air Pollution Control Association, 4400 Fifth Ave., Pittsburgh 13.

SEPT. 21-25—*Instrument Society of America,* instrument-automation conference and exhibit. International Amphitheater, Chicago. For information contact: Fred J. Tabery, exhibit manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7.

NOV. 2-5—*Air Conditioning and Refrigeration Institute,* 11th exposition. Atlantic City Auditorium, Atlantic City, N. J. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

1960

FEB. 1-4—*2nd Southwest Heating and Air Conditioning Exposition.* Memorial Auditorium, Dallas. Under auspices of the American Society of Heating, Refrigerating & Air Conditioning Engineers, in conjunction with the newly merged society's semi-annual meeting, also in Dallas. For information contact: International Exposition Co., 480 Lexington Ave., New York 17. ASHRAE headquarters: 62 Worth St., New York 13. ∓

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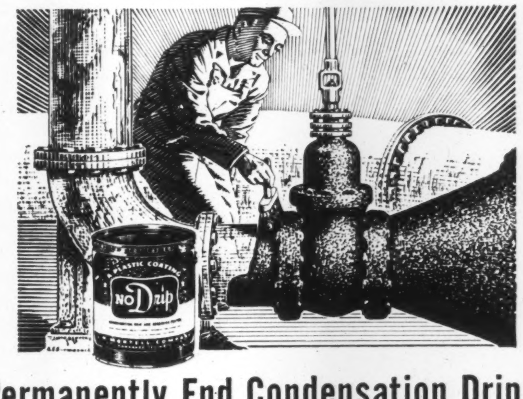

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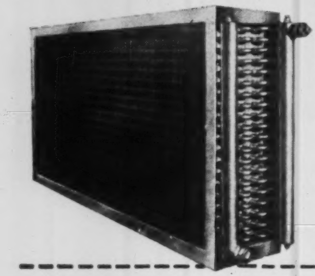
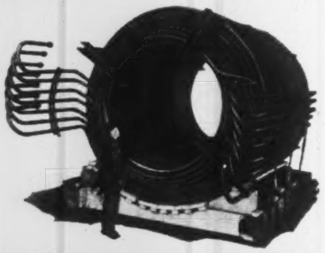
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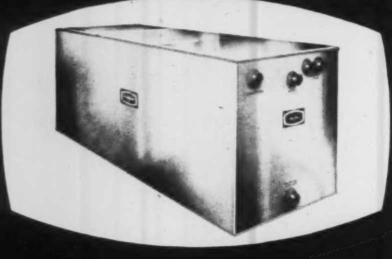
ADVANCED MECHANICS OF FLUIDS—Edited by Hunter Rouse. 444 pp. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. $9.75.

REFRIGERATION TERMS AND DEFINITIONS, American Standard B53.1-1958. American Society of Refrigerating Engineers, 234 Fifth Ave., New York 1. $1.25.

SINGLE-PHASE TRANSFER OF LIQUIFIED GASES, National Bureau of Standards Circular 596—By Robert B. Jacobs. 42 pp. Available from: Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 30c.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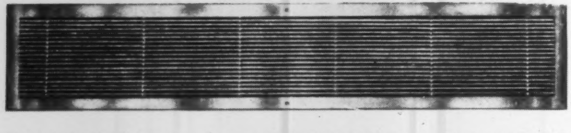
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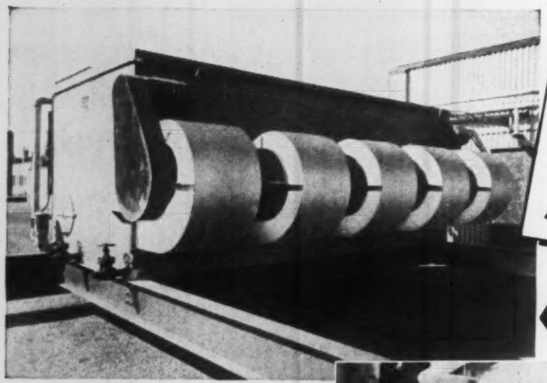

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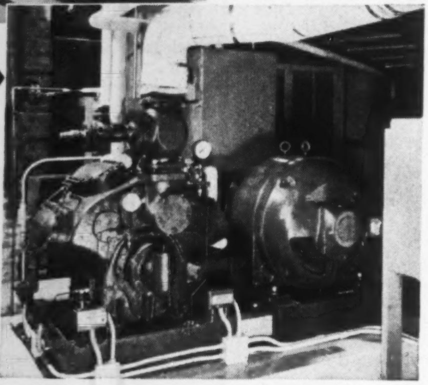

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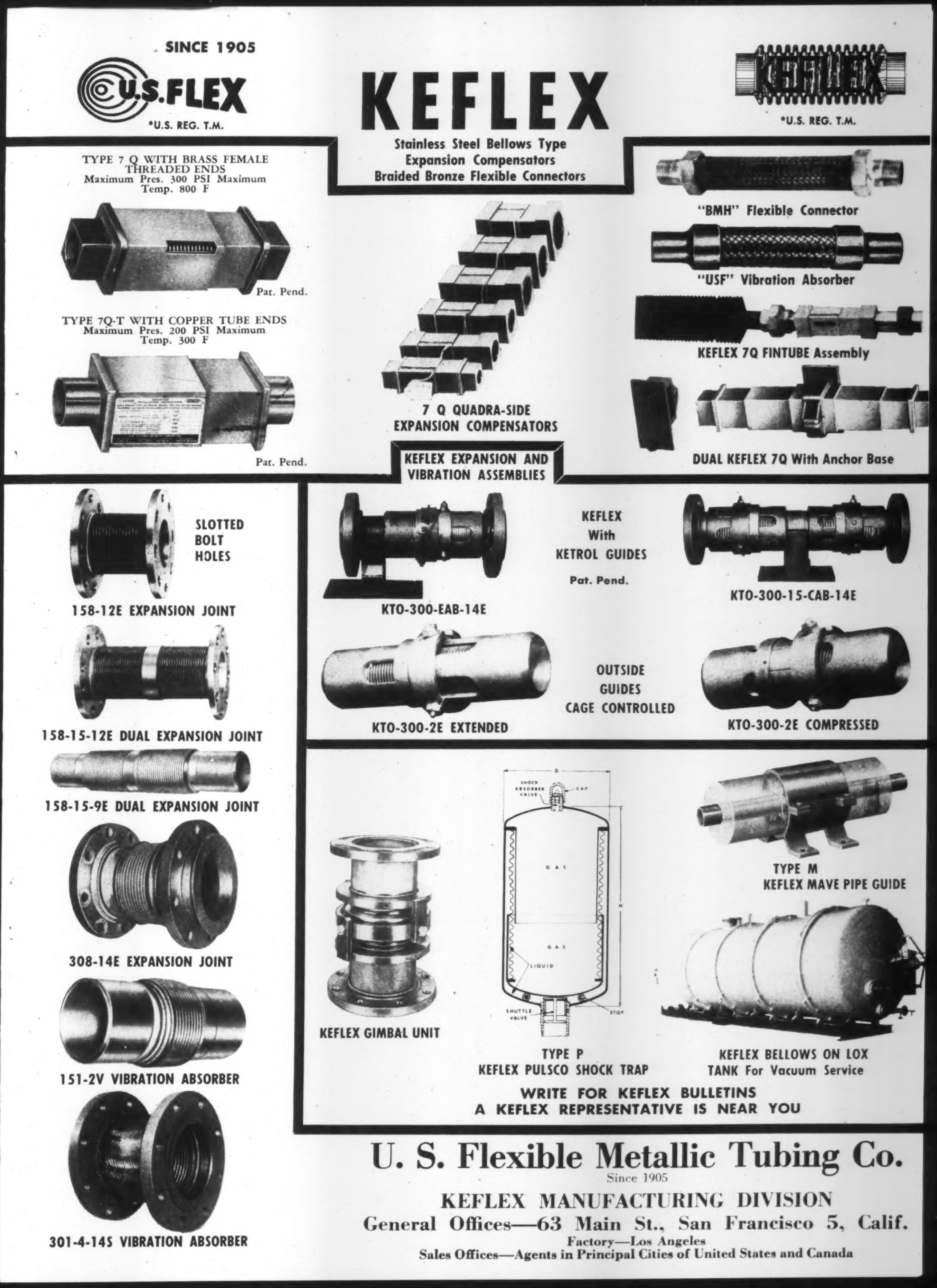

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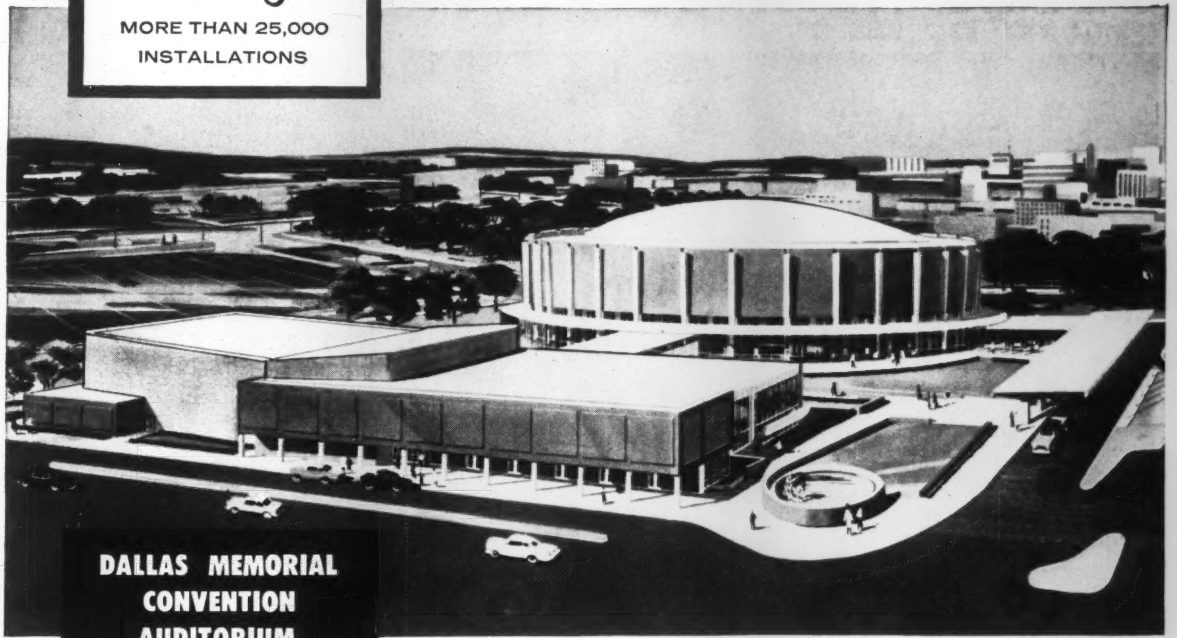

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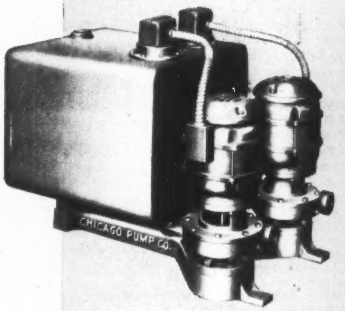

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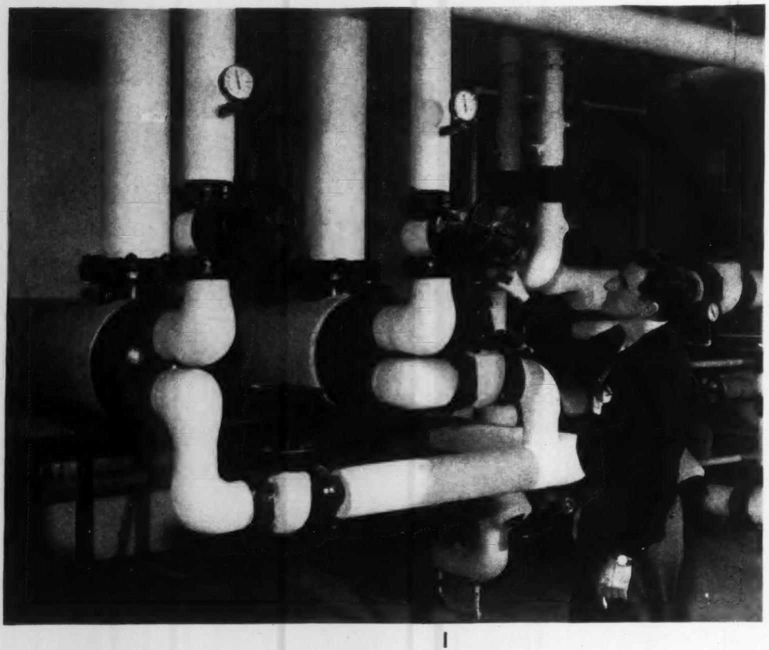

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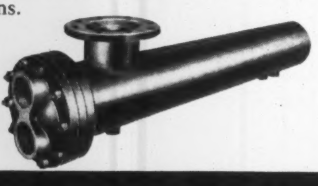

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Not 20 to 30 minutes—

but

Just 7 seconds to insulate

this bend!

New Johns-Manville AEROTUBE insulation

cuts labor costs 50%... and more!

New Aerotube® Insulation entirely eliminates twine wrapping, skirting and other time-consuming methods of insulating lines that sweat!

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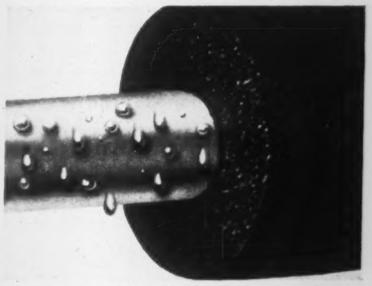

Aerotube insulation is its own vapor barrier.

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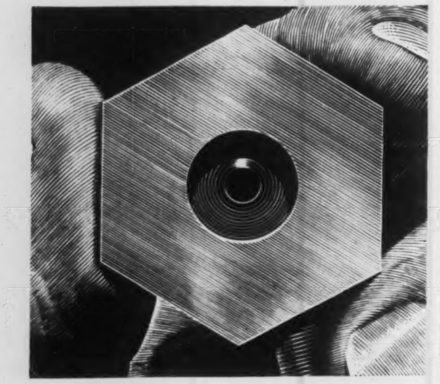

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* Patent Pending

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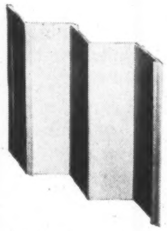

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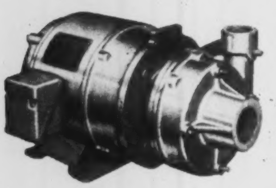

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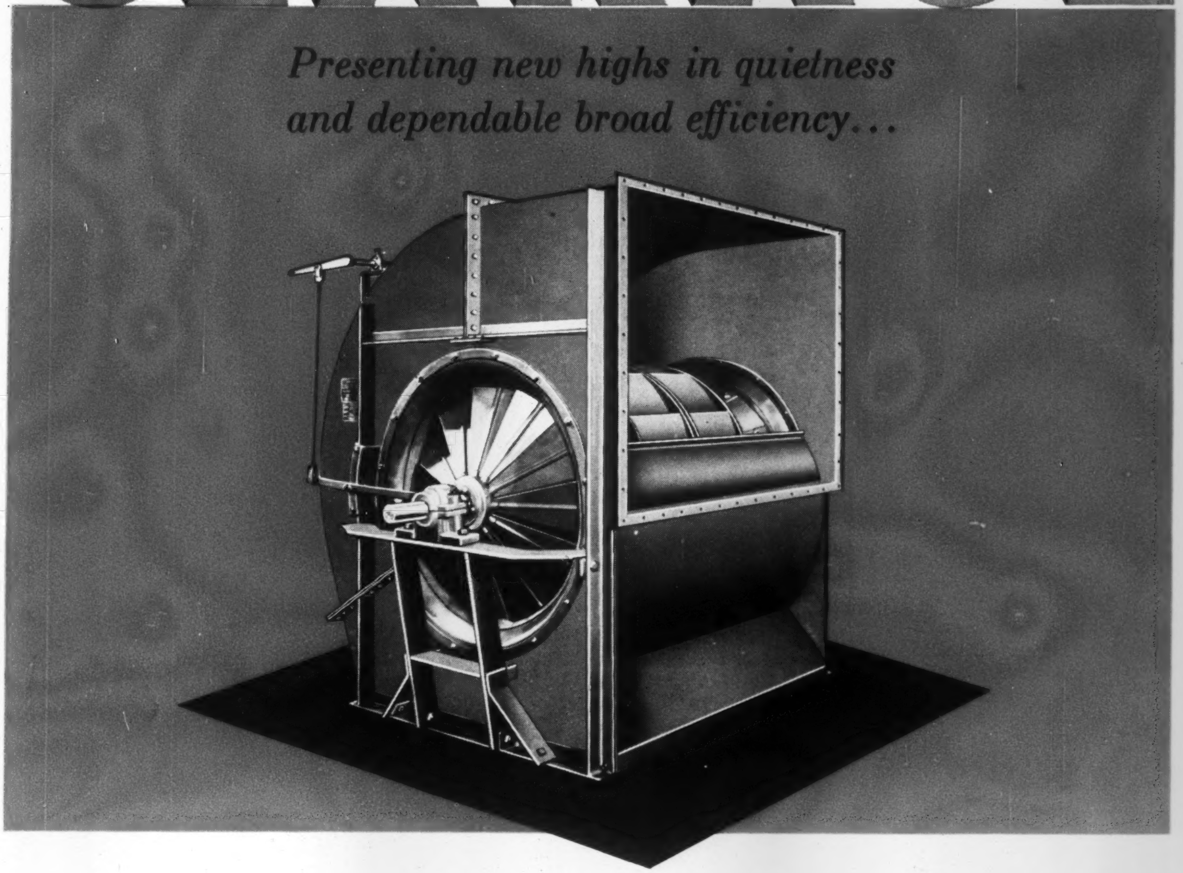

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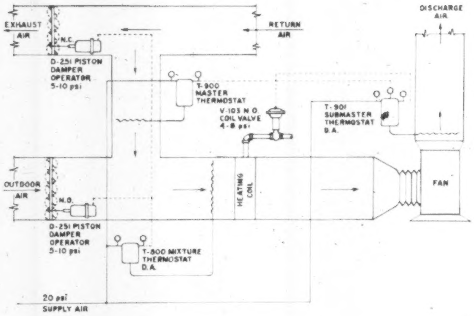
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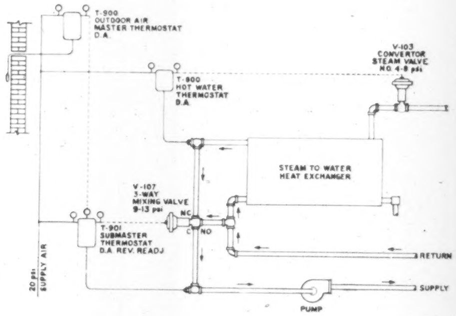
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RETURN
SUPPLY
PUMP

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